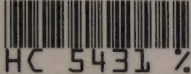
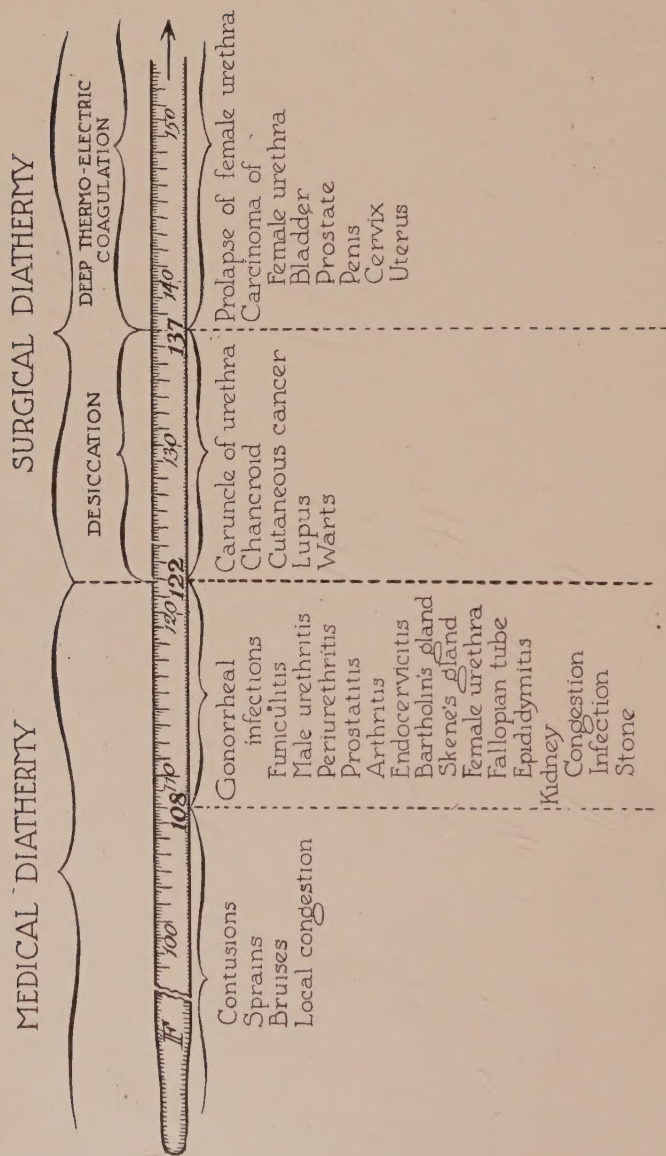


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


Schematic Drawing illustrating the degree of heat utilized in treating the different diseases of the genito-urinary tract with medical and surgical Diathermy.

DIATHERMY

In the treatment of Genito-Urinary Diseases
with especial reference to Cancer

BY


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MEDICAL AND SURGICAL
DIATHERMY

P R E F A C E

The standardization of methods in medical and surgical treatment has been largely responsible for the widespread and rapid improvement of therapeutic results in all parts of the world.

It is unnecessary to recall that our present-day progress has been entirely dependent upon the development of the fundamental sciences. As a single example we might mention the utilization of electrical energy which, along diversified lines, has brought forth many of our most valuable diagnostic and therapeutic aids.

The aim of this book is to show definitely and clearly the tremendous value of diathermy in the treatment of diseases of the genito-urinary organs. In so doing we will consider new applications of well known principles. It is our hope that the manner and rationale of our technic will tend in some small way toward an ultimate standardization of the therapeutic methods available for the alleviation of these conditions.

As urologists seeking newer and more efficient methods, we have tried to avail ourselves of the principles developed by our colleagues in the field of "electrotherapy" so that we might apply them in our various endeavors. Our clinical results warrant the assumption that the scientific and carefully selected use of diathermy will ultimately come to be one of the most valuable adjuncts in the armamentarium of those who are called upon to treat genito-urinary diseases.

30 North Michigan Avenue,

Chicago, Illinois.

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DIATHERMY

IN THE TREATMENT

OF

GENITO-URINARY

DISEASES

WITH ESPECIAL REFERENCE

TO CANCER

CHAPTER ONE

DEFINITION AND BRIEF HISTORICAL
NOTES

Nagelschmidt, of Berlin, is credited with being the originator of the term "diathermy." To avoid confusion it would be preferable if other synonyms could be discarded. "Endothermy," "thermo-penetration," "trans-thermy," "thermoelectriccoagulation," etc., seem to be preferred by various workers, and in some instances for plausible reasons. It would seem that along the lines of general standardization a single term which is the most thoroughly and universally descriptive would avoid the misunderstanding which already surrounds the definition of this method.

The definition of Zimmern, of Paris, that diathermy is "a form of thermotherapy which utilizes electrical energy for the production of thermal effects in the depth of the tissues," seems to us the most acceptable.

In 1890 d'Arsonval, of Paris, after repeating and elaborating upon the experiments of Ward, showed that if a current be reversed over five thousand times a second, the muscular contractions diminished in proportion to any increased periodicity. Diathermy is really the name applied to the utilization of the high frequency current under somewhat altered conditions. d'Arsonval must, therefore, be considered as the pioneer in this type of therapy.

Tesla, in 1891, showed that by using the rapid oscillatory discharges from Leyden jars, large currents of high potential could be passed through the human body with-

out harmful effects. During the same year d'Arsonval caused high frequency currents to pass through the human body and stated that he had personally passed 3,000 milliamperes through himself without any sensation except that of heat.

In 1896 d'Arsonval passed 500 milliamperes through his patients who noted distinct heating effects. In 1898 he began the treatment of disease with high frequency currents.

This was followed by the work of others, Bordier, LeCompte, Bouinot, Wertheim, Salomanson, Zimmern, Turchini, Nagelschmidt, von Berndt, von Preiss, and von Zeynech, all making valuable contributions on this subject.

According to Stewart, diathermy was first used in this country by Frederick DeKraft in 1906. Since this time the excellent work of Granger, McFee, Price, Sampson, Snow, Titus, Travell, Geyser and Stewart has done much to advance diathermy technic in the United States.

In 1910 Eugene Doyen described a method for the treatment of cancer by means of electrically produced heat.

In 1910 Nagelschmidt demonstrated the use of high frequency currents in the treatment of disease at St. Bartholomew's Hospital, London, in the clinic of Mr. Harmer.

Carlos Santos, of Lisbon, has been a persistent worker in the application of diathermy in a non-surgical manner.

Cumberbatch and Saberton, of England, have stimulated others by their timely reports.

There have been many others, both in this country and abroad, whose careful and creditable work has brought about the furtherance of diathermic principles, but limitation of space prevents a complete historical résumé.

TECHNICAL CONSIDERATIONS

The history of the application of diathermy and other forms of heat in the treatment of cancer will be briefly reviewed in a subsequent chapter on this subject.

Our only reason for touching upon the development of this type of therapy in so limited a treatise is that we may point out that diathermy has been gradually but carefully developed, especially from the technical point of view, until its clinical application is now open to wider, and possibly more useful, fields of therapeutic endeavor.

Technical Considerations

It is not our intention to enter into a detailed discussion of the physical principles which govern the development and application of the type of current suitable for diathermy. We will take up only the technical and physiological considerations pertinent to the therapeutic methods described. (*)

Fundamental Principles

Electrical currents heat the conductors through which they pass and the amount of heat depends upon the resistance to which the current is subjected, i. e., the greater the resistance the greater the heat. It is impossible to raise the temperature in the depth of the tissues by the ordinary continuous (galvanic) current because of the severe pain produced by strong applications at the areas of contact. Similarly, the faradic current cannot be used for the reason that it not only produces pain but also violent muscular contractions.

(*) These should be obtained by consulting one of the following texts:

Diathermy in Medical and Surgical Practice. By Claude Saberton. Cassell and Co., Ltd., London-New York, 1920.

Diathermy. By E. P. Cumberbatch. London. 1921.

Diathermy and Its Application to Pneumonia. By Harry E. Stewart. Paul B. Hoeber, Inc., New York, 1923.

Physio-Therapy Technic. By C. M. Sampson. C. V. Mosby Co., St. Louis, Mo., 1923.

D I A T H E R M Y

By employing currents which reverse their direction many thousands of times per second (high frequency) diathermy can be accomplished.

Quoting from Saberton . . . "d'Arsonval high frequency currents and diathermy currents have certain characteristic differences; in the former the oscillations are not sustained, have high voltage and low amperage, while the latter are characterized by more sustained oscillations, low voltage, and high amperage."

It is necessary to develop a current of low voltage and relatively high amperage as compared with static. Deriving the ordinary alternating current of 110 volts from a wall socket, the voltage is increased to many thousands by means of a "step up" transformer within the machine. A second transformer increases the frequency of oscillation. The relative amount of current which is passing through the patient is recorded by a hot wire ammeter—the expansion of the wire moving the meter needle on the scale which is graduated in milliamperes. As will be discussed later, it is advisable when possible to devise electrodes with thermometer attachment so that the degree of heat in the region of the area of contact may be estimated. This is a far more accurate index of heat production because the milliampere meter does not record the exact current density. The latter varies with the amount of current, the resistance of the tissues through which the current is passing and the area of electrode contact with the body.

The upper limit of safety has been estimated as 100 ma. per square inch of electrode. This will naturally vary somewhat with the size and shape of the electrodes. Thermometer readings, when possible, give a more accurate control.

If the electrodes are of equal size the maximum generation of heat is obtained midway between them. If elec-

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trodes of unequal size are used the current density, and, therefore, the heat generation, is greater a short distance below the smaller electrode. This fact constitutes the keynote of success in diathermy, for, by means of variation in electrode size and shape, we are able not only to produce heat in the depths of tissue but to localize it within a given area.

Physiological Effects

The therapeutic value of heat has been known to all ages. Before the introduction of diathermy our only means of developing internal heat was by making an external body application in an effort to drive the heat through the skin into the deeper tissues.

Heated moist dressings, hot water bottles, linseed, mustard or bread poultices, hot mud packs, hot tub or sitz baths, etc., are time honored remedies of proven individual value. More recently the dry contact heat of electric pads or the radiation of electrically heated incandescent bulbs, has proven effective in producing a slight depth of body heat dissemination.

In diathermy we have a form of heat absolutely different from any applied to the body externally. The current passes by a direct path from electrode to electrode. The relative tissue resistance between the poles does not materially affect the course of heat production and the current, therefore, takes the direct rather than the easiest path.

Sampson¹ has appropriately expressed the manner in which such high voltage may be passed through the body without harm: "The transformation of a dangerous current into a high frequency current can be compared very aptly to what takes place when a very high pressure, large volume stream of water is nebulized. Before going through the nebulizer the stream of water is extremely

DIATHERMY

dangerous to life, and if attempt were made to use it for the irrigation of delicate plants not only would the plants be destroyed but great holes would be torn in the soil, etc. After the stream has passed through a giant nebulizer which reduces it to a vapor so light that it will float in the air, the same stream of water can be sprayed upon the most delicate of plants with none except the most beneficial results."

In like manner the diathermic current, with an extremely rapid oscillatory rate, brings about such a rapid ionic movement within the tissues that only heat dispersion results.

General Therapeutic Effects of Heat

The most important effect of diathermy is the production of localized internal heat. It is well known that increased heat within living tissues results in an active hyperemia and the special characteristics of diathermic heat permit deep penetration and an accurate directability to any internal structures desired.

Bier (*) has shown that hyperemia has distinct *analgesic, bactericidal, absorptive, solvent and nutritive* effects.

The analgesic effects of the hyperemia resulting from heat generation in living tissues is ideally effected by diathermic currents. Heat may be localized within the depths of areas hitherto inaccessible to any form of external heat. The actively circulating heated blood causes absorption of the products of inflammation, promotes tissue oxidation, stimulates metabolism and by the ultimate relief of congestion and by increased tissue drainage gives marked relief from pain. It is possible that the hyperemia produced within the neurone pressure region

(*) "Hyperemia as a Therapeutic Agent," by Professor August Bier, translated by Dr. Gustavus M. Blech. A. Robertson & Co., Chicago, 1905.

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is the result of "the specialized effect of diathermy upon sensory nerve endings."

The body tissues react to injury and infection by a process known as inflammation. If injury occurs without infection the type of inflammatory reaction which results is a physiological process which tends to increase metabolism and cellular activity in the injured region, thereby hastening repair.

When inflammation is due to infection there is also increased metabolism accompanied by localized or generalized increase in temperature. As Geyser² has pointed out, inflammation is nature's attempt to cure, and its principal factor is the production of heat. By means of diathermy physiological heat is generated within the tissues thereby assisting nature to react and cure disease.

The bactericidal effect of the active hyperemia resulting from increased heat production was utilized by both physicians and laymen long before the bacterial nature of inflammation was understood. Most of the organisms pathogenic to the human body thrive best at normal body temperature. With the modern diathermic current the temperature in the medium surrounding the areas of bacterial invasion is artificially increased so that the virulence of the organisms is lowered, the rate of generation is retarded and they become more susceptible to the defensive powers of the body. This reparative process is presumably brought about by increasing the flow of blood in the capillaries, augmenting glandular activity and producing a defensive transudate of serum and phagocytes in the tissues outside the capillaries.

Crile³ states that, "with the rise of each degree of temperature in any system, inorganic or biologic, the chemical activity is increased 10 per cent and the electrical conductance 2.5 per cent. The increased chemical

D I A T H E R M Y

activity increases the chemical defense; the increased electrical conductance increases the metabolism."

The natural method of increasing the heat of the body is called "fever." Diathermy produces a localized fever which can be applied to any selected region. The beneficial effects of natural fever are augmented by the fact that the artificial production of internal heat is practically unlimited and is not attended with generalized functional impairment of the body.

Saberton⁴ states, "the artificial general pyrexia resulting from a diathermic treatment differs from ordinary pyrexia in that it is not produced by toxins circulating in the blood stream. After cessation of treatment the heat regulating mechanism quickly eliminates the excess of heat and the temperature returns to normal."

The absorptive effect of the localized hyperemia induced by diathermy is brought about by increasing the quantity of water, and water-soluble bodies, that are carried away from the edematous tissue through the vascular channels.

The solvent effect produced by diathermic hyperemia is presumably brought about by causing increased chemical action, or hyperemic increase of phagocytic action upon partially organized clots or fresh calcareous deposits.

The nutritive effect of hyperemia is most valuable by virtue of the increased metabolic changes resulting in accelerated tissue oxidation and stimulation of physiological processes both chemical and physical.

In the cutaneous tissues beneath the electrodes only a mild hyperemia results. There is a moderately increased activity of the skin glands resulting in slight perspiration.

Quoting from Stewart⁵: "It must be evident that all glandular activity is greatly augmented by this increase in capillary blood supply. Some confusion has arisen in

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regard to the effect of this current upon tissues already passively congested, the fear being expressed that diathermy would result in still further congestion. As a matter of fact, while the total amount of blood in the area under treatment is increased temporarily, passive congestion is relieved for the following reason: It is in the capillaries that the greatest resistance to the circulation takes place. We have all noticed the slowing up of the blood stream in the frogs' web and the curling up of the red blood cells in their attempt to squeeze through this narrowest part of the blood stream. Under the effect of diathermic heat the dilatation of the capillaries decreases this resistance and augments the return flow as well as the volume of the blood stream. *Hence, previous congestion is not a contraindication but rather the reverse for the use of diathermy."*

Electrodes

In all our work we have used flexible sheet metal plates of block tin, or the wire mesh, for the large flat electrodes.

In the event of using a small, specially designed electrode for regional concentration of heat we, somewhat improperly, call this larger electrode the "inactive" one. It is obvious that in the use of diathermy neither electrode is more "active" than its fellow except where a marked disproportion of contact surface exists.

The question of success in the use of this modality depends largely upon the development of special electrodes which are peculiarly applicable to the individual structures, as well as the particular condition, which we wish to reach with the induced heat.

The special electrodes which we have devised will be discussed later in their application to the various genito-urinary conditions.

DIATHERMY

General Technic

Most patients will be extremely apprehensive of their first diathermy treatment. It is well to assure them that there will be absolutely no pain connected with the treatment and that, if they obey instructions, they need fear no untoward complication. Any sensation of excessive heat or hyperesthesia should be reported at once.

If these points are thoroughly impressed upon the patient he will relax completely and will not feel that pain is a necessary attendant to the application. The latter will assist in the prevention of superficial burns in those cases where direct thermometer guidance is impossible.

It is best to have all cords completely insulated to the very point of attachment. A small rubber cuff can be slipped over this point after the attachment has been made.

Gauze pads which are slightly larger than the electrode surface can be soaked in warm hypertonic saline solution and superimposed between the skin and electrode surface. It is essential that they be kept moistened during the course of treatment. In some instances shaving soap can be applied on the contact surface of the electrode giving more satisfactory results than those obtained with the salt solution pad. The chief objections to the latter are that the electrode may slip over the edge of the gauze or in prolonged applications the drying out process may destroy its efficiency.

Intimate contact of all the electrodes is most essential. Where special electrodes are used they must be designed to fit the contour of the surface or lumen smoothly. Cutaneous electrodes should be held in place by sand bags, adhesive strapping or other suitable means.

Before starting the application a careful inspection of all contacts should be made and care taken that all switches are closed.

GENERAL TECHNIC

It is advisable to increase the current slowly, taking several minutes before inducing the maximum amount of heat. At the completion of the treatment the current should be reduced gradually over a period of two or three minutes.

Skin abrasions, open or bleeding wounds should not have electrodes placed directly over them.

THE APPLICATION OF
MEDICAL
DIATHERMY
IN
GENITO - URINARY
DISEASES

CHAPTER TWO

EFFECTS OF HEAT UPON THE GONOCOCCUS

It is a well known fact that the gonococcus has a very low resistance to even slightly increased body temperature. One who is familiar with the management of gonorrhea in the male is frequently impressed with the number of "spontaneous cures" of gonorrhea directly following a severe epididymitis or prostatitis which has been accompanied for a number of hours with a temperature of 102-103° F. We have repeatedly seen the gonococci disappear permanently from the urethra during acute respiratory infections, such as influenza or pneumonia, in which a temperature of 102 or more degrees had persisted for more than several hours. The pyrexia of typhoid has accomplished complete riddance of the gonococci in several of our patients.

Experimental studies of the gonococcus grown in vitro do not help us in determining their relative resistance to heat. This is due to the fact that their viability on artificial media is poor under the most favorable circumstances. Gonococci are destroyed if the temperature of the medium on which they grow is raised a few degrees above normal. It has been repeatedly shown in our own work that cultures of these organisms do not survive if they are kept over night in an incubator the temperature of which has risen to over 102° F. (39° C.).

Laquer (cf. Cumberbatch and Robinson) injected emulsions of living gonococci into the joints of dogs and found that the joints which were exposed to diathermy contained sterile fluid, while the untreated joints still contained living organisms.

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The destructive effect of high body temperature upon various parasites, such as the body louse, offers a striking example of gradually diminishing vitality on the part of a foreign invader.

Every living cell, whether it be animal or vegetable in origin, thrives ideally at a certain optimum temperature. As this temperature is elevated the normal electro-chemical mechanism of the cell is exceeded until gradual disintegration occurs. This may be a process of protoplasmic dessication, of nuclear destruction, or as Crile⁶ has recently suggested—"an equilibrium of potential."

As we all know, the safety of modern surgery rests upon the known vulnerability of pathogenic organisms to heat. Unfortunately the majority of these cells are even more resistant to induced heat than a given normal body cell and, therefore, cannot be destroyed in the living organism directly without attendant tissue extinction. This is not true of the gonococcus.

It has been frequently demonstrated that the gonococcus is instantly destroyed at a temperature of 113° F. (45° C.) or at 104° F. (40° C.) prolonged for six to eight hours. Where the gonococci can be localized in the tissues an exposure to 108° F. (42.3° C.) will destroy them in thirty or forty minutes.

Since the normally nourished epithelial cell can survive a temperature of 118° F. (47.8° C.) to 120° F. (49° C.) for one hour or more, and connective tissue cells are resistant to longer periods of heat at an elevation of more than 122° F. (50° C.), the rationale of the therapeutic possibilities for destroying the gonococcus within the living tissues by diathermy is manifest.

With the advent of the more modern high frequency machine it has become possible to maintain sufficient heat in "the depth of the tissue" to destroy the gonococcus by diathermy. Our problem, therefore, becomes a technical and not a fundamental one.

CHAPTER THREE

GONORRHEA IN WOMEN

Ever since the human race has been afflicted with gonorrhea the female genital organs have suffered not only from the effects of the gonococcus but also from the many methods that have been suggested for their relief. In a large measure this has been due to the anatomical structures affected and to the lack of a definite knowledge of the pathology of the female urogenital tract following the acute stages of gonococcal infection. It is unnecessary to review the many methods which have been tried for the relief and cure of this stubborn infection. It is well known that a large percentage has failed to effect a cure because of the obstinacy of the endocervicitis and the inaccessibility of the maculae gonorrhoeae to topical applications. Therefore, it is not surprising that surgery, as a final resort, has been so often employed in an attempt to clear up this chronic infection.

Curtis,⁷ in investigating the bacteriology and pathology of the Fallopian tubes removed at operation, has shown that "chronic endometritis, as a clinical entity, is very uncommon, and that persistent infection of the endometrium seldom exists unless maintained by other lesions, such as cervicitis or cellulitis."

"The corporeal endometrium tends to remain free from chronic infection. Histological examinations and cultures from cervixes obtained at operation have revealed that bacteria frequently lodge in these tissues; especially in the vicinity of the actively secreting glands of the mucosa. It has been found also that granulations and strictures are often present in the canal of the cervix. It has rarely been possible to obtain gonococci in cultures from thoroughly ground Fallopian tubes removed from

DIATHERMY

patients who have been free from fever and leukocytosis for a period of ten days or two weeks." The Fallopian tube, therefore, can hardly be considered as a focus for perpetuating a chronic gonorrheal infection of the cervix. "Persistently active gonorrhea of the tubes is evidently ascribable either to recurrence of infection from without or repeated invasion of bacteria from the chronically infected lower genital tract."

"If the patient can be early isolated from the source of the infection, a single attack of gonorrheal salpingitis is usually borne without protracted clinical symptoms or severe pathological results. In a series of three hundred patients with evidence obtained by the histories, examination of the external genitalia, and operative findings combined with laboratory studies, it was ascertained that the gonococcus was responsible for 70 per cent of the cases."

Further investigation by Curtis, comprising a combined bacteriological and histological study of the endometrium in health and disease, has shown that chronic endometritis, *per se*, with bacteria present in smears or cultures, is practically to be ruled out as a clinical entity.

"The gonococcus is most frequently found, because it is the infectious organism most often brought in contact with the cervix. Since chronic infections of the corpus uteri are, as a rule, secondary to infections in other pelvic organs, intrauterine treatment has little value, because the focus of infection is not within reach." The discharge that is the most infectious and persistent comes from the endocervical glands. It is here that treatment must be directed as the gonococcus localizes in the glands of the cervix and endocervix and is the predisposing cause of a chronic purulent discharge in a large percentage of women who have not borne children and the predisposing cause many times of leukorrhea in women who have borne children.

THE CORBUS CERVICAL AND URETHRAL THERMOPHORE

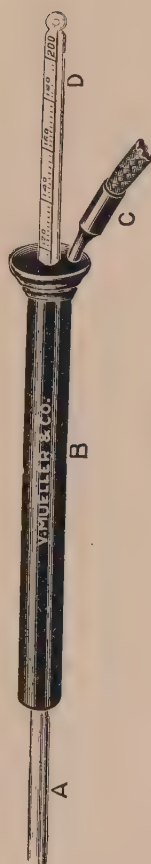


PLATE II

The instrument consists of a very thin nickel silver shell, *A*, closed at one end and measuring 5 millimeters in diameter. A hard rubber sheath, or covering, *B*, measuring 15 centimeters in length and 1 centimeter in diameter is attached, thus allowing an extension of 4 centimeters for insertion in the uterus. An insulated terminal, *C*, is provided for attachment of the cable, supplying current. A thermometer, *D*, is inserted to the full depth of the shell and reading taken from the exposed portion. It has been found that the greatest accuracy is necessary in constructing the instrument to insure its proper performance. Any small diathermy machine capable of supplying 800 to 1,000 milliamperes will produce heat enough to apply the thermophore.

GONORRHEA IN WOMEN

We must accept the fact that gonorrhea persists in women largely because of the continued presence of the gonococcus in the para-urethral, the cervical and the endocervical glands. Frequently the continued application of locally effective germicidal agents will bring about a complete disappearance of the gonococci in these structures. But in a great many women treated by douches and local applications, the gonococci remain securely in the depth of the endocervical glandular tissue. A germicidal agent is therefore needed, which will penetrate the active foci. It is evident that heat constitutes the most ideal gonococcide, provided it can be induced into the depths of the tissue and so controlled that it will destroy the infection and leave the normal tissue unharmed.

We have found that it is possible to maintain a temperature of 116 to 117° F. (46.5 to 47.5° C.) within the cervix for forty minutes without causing pain, discomfort, or tissue destruction.

In the female urethra a temperature of 113° F. (45° C.) can be induced for one hour without pain or subsequent tissue destruction.

Description of Cervical and Urethral Thermophores

The thermophore consists of a very thin, nickel-silver shell (A), closed at one end. These are made in varying diameters to suit individual needs. As a rule, we find three sizes will cover all emergencies. The smallest is 3 millimeters in diameter and can be used in young adults, nullipara, or in the earliest treatments in a scarified sclerotic multiparous cervix. The 5-millimeter diameter is more universal and, if only one instrument is to be had, is most satisfactory for the average case. For use in the gaping, previously lacerated cervixes of multiparae a 7-millimeter diameter gives more intimate contact.

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A hard rubber sheath, or covering (B), measuring 15 centimeters in length and 1 centimeter in diameter is attached, thus allowing an extension of 4 centimeters for insertion into the cervical or urethral canal.

An insulated terminal (C), is provided for attachment of the cable, supplying current. A thermometer (D), is inserted to the full depth of the shell and reading is taken from the exposed portion.

Technic

The patient is placed in the lithotomy position. The indifferent electrode, 4 by 6 inches in size, is made of block tin or wire mesh. This is placed over the supra-

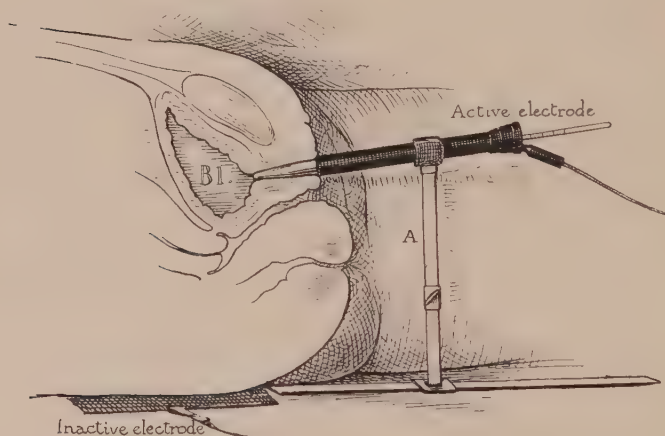
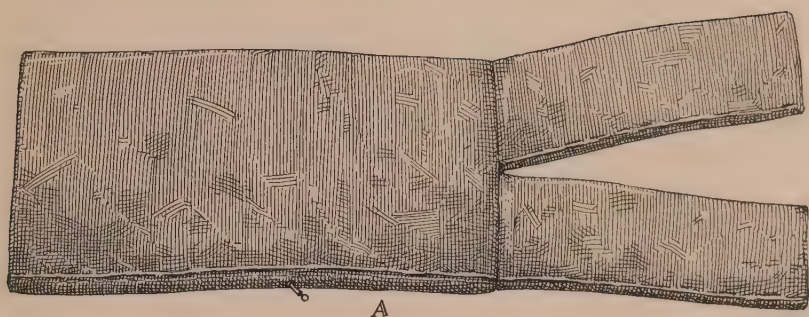


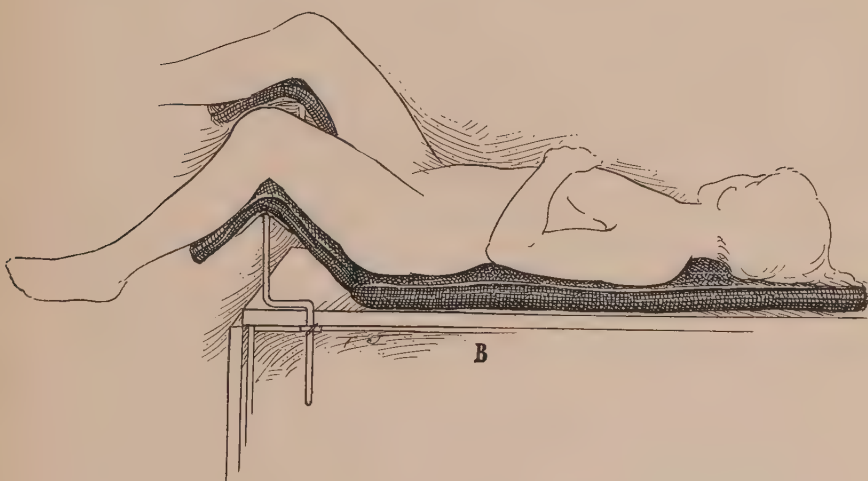
PLATE III

Illustrating the thermophore as used in the treatment of diseases of the female urethra. The inactive electrode may be placed either beneath the buttocks or over the supra-pubic region; or the patient may lie upon the autocondensation pad.

pubic and sacral regions at alternate treatments. Since the current tends to travel as far as it can on the active electrode and then proceeds in a direct path to the inac-



A



B

PLATE IV

A. The O'Conor autocondensation pad, the end of which is so fashioned that it may be applied to the ordinary gynecological table for treatment in the lithotomy position.

B. Diagrammatic sketch of patient resting entirely upon the autocondensation pad and in position for urethral or endocervical treatment.

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tive electrode it seems most rational to change the inactive electrode so that the urethra or cervix may be thoroughly heated in both directions. The method which we now use we believe is still more efficient. The active electrode is secured within the urethral or cervical canal and the patient is placed upon a condenser couch, the ends of which are split trousers-like so that the pads pass over the leg rests. In this way the entire body acts as the indifferent electrode and there is a more uniform dissemination of heat on all sides of the urethral or cervical thermophore.

It should be emphasized that the thermometer registers the actual heat imparted to the active electrode by contact with the surrounding tissues and not the amount of heat formed in the electrode itself. It must be admitted that there is still a small fraction of error in the regulation of this temperature but the amount seems negligible in controlling the destruction of the gonococcus.

The labia are retracted and all parts thoroughly cleansed. The patient should empty the bladder before the electrode is inserted into the urethra. The thermophore is lubricated with sterile oil or glycerin and gently inserted into the urethra. It is then held in position by an adjustable metal arm which rests upon the table. The proximal end of the rubber sheath should be in intimate contact with the external orifice.

When all contacts are completed the current is gradually turned on. When the thermometer registers 105° F. (40.5° C.), wait five minutes and then increase the current until 108-109° F. (42.5° to 43° C.) is reached. If this is well tolerated, and it practically always is, increase again after five minutes to 112-113° F. (44.5 to 45° C.). If no pain or tingling occurs at this point the application should be continued for thirty minutes and the current then gradually decreased over a period of two or three minutes.

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Occasionally during the treatment the patient will have a desire to void. This has always disappeared after a few minutes. There is no harm if the patient does urinate with the electrode in place. A small basin may be placed beneath the buttocks to care for this emergency.

Cervical Application

A vaginal speculum is inserted, all mucus, pus and debris is removed from the cervical canal and vagina by means of moist alkaline swabs. The tissues are sponged dry and the thermophore is then placed in the cervical canal and either anchored to the speculum by tying the thermophore to the adjusting screw with ordinary string or held in place by an adjustable metal attachment.

The current should be increased gradually until the thermometer registers 116 to 117° F. (46.5-47° C.). It is then stabilized and continued at this point for thirty to forty minutes. The thermophore should be kept under constant attention during the entire treatment.

Dull, cramp-like distress in the pelvis is a frequent complaint at the onset of this treatment but invariably passes away in a few minutes. Other than this the treatments are absolutely painless as evidenced by the fact that many fall asleep during the seance.

The sedative effect of a single diathermy treatment to the female urethra is most gratifying.

The first urination after the treatment is occasionally accompanied by some burning and discomfort but thereafter the relief is usually complete. Frequency, urgency and dysuria are no longer troublesome, and sedative drugs are rarely necessary.

In the average case the gonococcus cannot be found in the urethral strippings after one or two treatments. It is well known that under ordinary methods of treatment

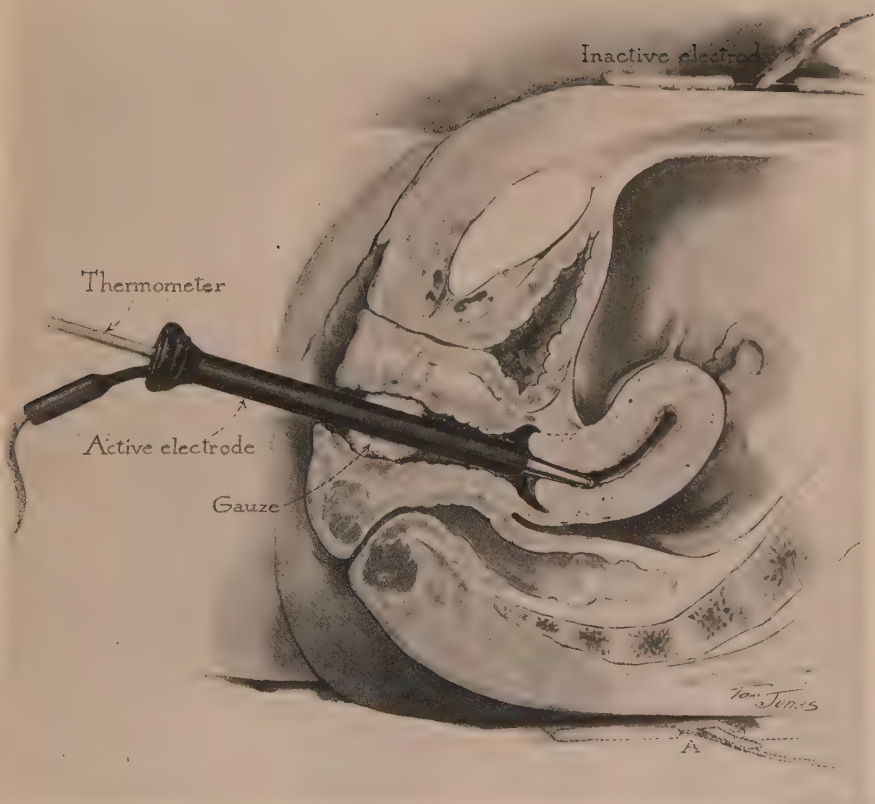


PLATE V

Method of applying Diathermy in Gonorrheal Endocervicitis. The inactive electrode may be placed alternately just back of the symphysis pubis or beneath the sacrum. If available, an auto-condensation pad is preferred. The cervical thermophore comprises the active electrode. By means of the diathermy current the heat is passed between the two electrodes, the active electrode being the smaller localizes the heat directly around it. The thermometer that passes into the core of the instrument registers approximately the degree of heat in the tissues immediately surrounding the electrode.

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the gonococci do not persist in the urethral mucosa for prolonged periods, unless there is coexistent infection of the para-urethral glands. However, their more rapid disappearance after diathermy has been uniform and the absence of subsequent para-urethral infection tends to the

THE WIRE BATH SPECULUM

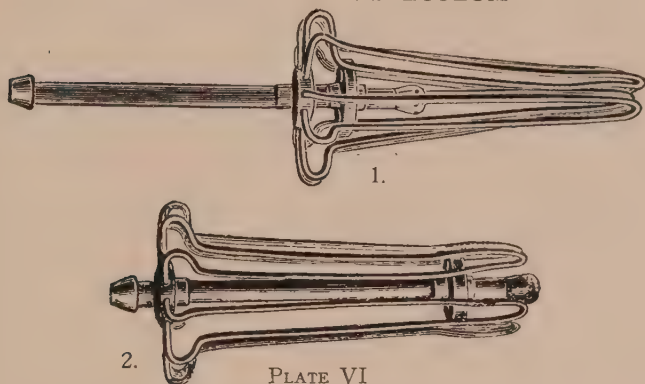


PLATE VI

1. The Instrument as it should be when inserted. Under no consideration is the patient allowed to insert the speculum unless lying flat in the bath tub. 2. The instrument with plunger pushed forward, thereby giving the maximum effect of the Hot Sitz Bath.

belief that the urethral application is valuable for prevention of this complication.

In forty-one instances of acute gonorrhea in the female, where this type of heat was directed to an infected urethra in which no evidence of para-urethral infection existed at the time, only one developed this complication later on.

On reviewing the records of forty-eight cases in which diathermy treatment was continued to a complete cure of the urethral infection, we find that in only three was it necessary to treat the urethra more than three times.

The frequency of diathermic applications to the endocervix varies in the individual case. Originally we did

not begin endocervical treatment in the very early acute stage. Repeated hot sitz baths and copious vaginal irrigations of colloidal silver solutions were used to palliate the condition for a week or ten days and then active diathermy treatment was started. More recently in widely dilated cervixes we have begun diathermy treatments at once unless the menstrual period was impending. We now believe that acute congestion and inflammation is an indication rather than the reverse for the use of diathermy, and that with intelligent application, complications will not be brought about by the use of this modality.

Endocervical treatments are repeated every seven to ten days. It is usually advisable to wait until three days after the cessation of the menstrual flow. Occasionally the onset of the menses is advanced several days when repeated cervical treatments have been applied during the preceding four weeks.

In the interim between treatments a wire vaginal bath speculum may be inserted by the patient herself two or three times a week. She then remains in the hot bath for one-half hour. The heat of the water should be gradually increased from 100 to 110° F. (37.78 to 40° C.).

Our routine has been to study microscopically the cervical discharge coincident with each heat application. The treatments are continued until the gonococcus has been absent from five successive smears. The patient is then instructed to return twice monthly for examination of the cervix and urethra. One of these examinations is made forty-eight hours after the cessation of the menses. If no gonococci are found during the first two months an endocervical application of 5 per cent silver nitrate solution is made and smears obtained twice during the week that follows. If these are negative, the patient is declared well.

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It should be emphasized that three negative cervical smears taken in quick succession after cessation of a given method of treatment do not justify the assumption of a permanent cure.

Infection of para-urethral (Skene's) glands will be discussed later.

It must be distinctly understood that this form of treatment in no manner replaces surgery, where surgery is indicated. Bartholin gland abscess, fistulae, salpingitis or pelvic abscess call for separate consideration.

This method is contraindicated during pregnancy, or when evident suppurative pelvic inflammatory changes, such as encysted salpingitis or pelvic cellulitis are present.

Clinical Results

We realize that any claims for a permanent cure of gonorrhea in women must be based upon a long continued observation. We have now had an experience of almost five years with this method, and during this time we have had the opportunity of repeatedly examining many of these patients and have thus been able to satisfy ourselves that this method brings about a complete and permanent elimination of the gonococcus.

Fifty-five women have had continued treatment by this method. Of this number twenty-four have been observed repeatedly during the past three years. Thirty-eight had been checked for two years. The remainder were not seen after the cessation of active treatment and were not available for observation after the three month period following the application of their discharge technic.

The most pertinent point about this method of treatment lies in the fact that its application entails painstaking co-operation between patient and physician, slightly more prolonged office treatment than is usual, and suffi-

cient intelligence on the part of the patient to realize the importance of getting completely well.

For these reasons we have been able to apply this method only to private patients of the more intelligent class.

Para-urethritis. (Inflammation of Skene's Glands)

There are two important para-urethral glands (Skene's). They are situated, and have a minute duct opening, on either side of the meatus. It is possible that these glands may be primarily infected by the gonococcus but their infection is usually secondary to a urethritis. Inflammation here is practically always gonorrheal in origin although in very chronic affairs the gonococcus may give way to secondary invaders.

The majority of these infections clear up very rapidly after urethral treatment with diathermy. As mentioned before, we believe that the heat treatment of the urethra prevents the occurrence of deep-seated para-urethral infection.

When Skene's glands are swollen and red with widely enlarged ducts exuding the characteristic gonorrheal pus, they call for additional consideration.

Our method has been to cleanse the mucosa by copious antiseptic irrigation and stain the surface with mercurochrome-220. A fine needle electrode is then carefully passed into the duct and inserted a half inch into the tissues. The inactive electrode is placed over the suprapubic region. The weakest current is applied so that the heating process will be as slow as possible. In a short time the tissue immediately surrounding the needle becomes white and dry and the current is turned off. The point of the needle can be slowly moved about and the low degree of heat reapplied if there is evidence of enlargement of the gland or regional infiltration.

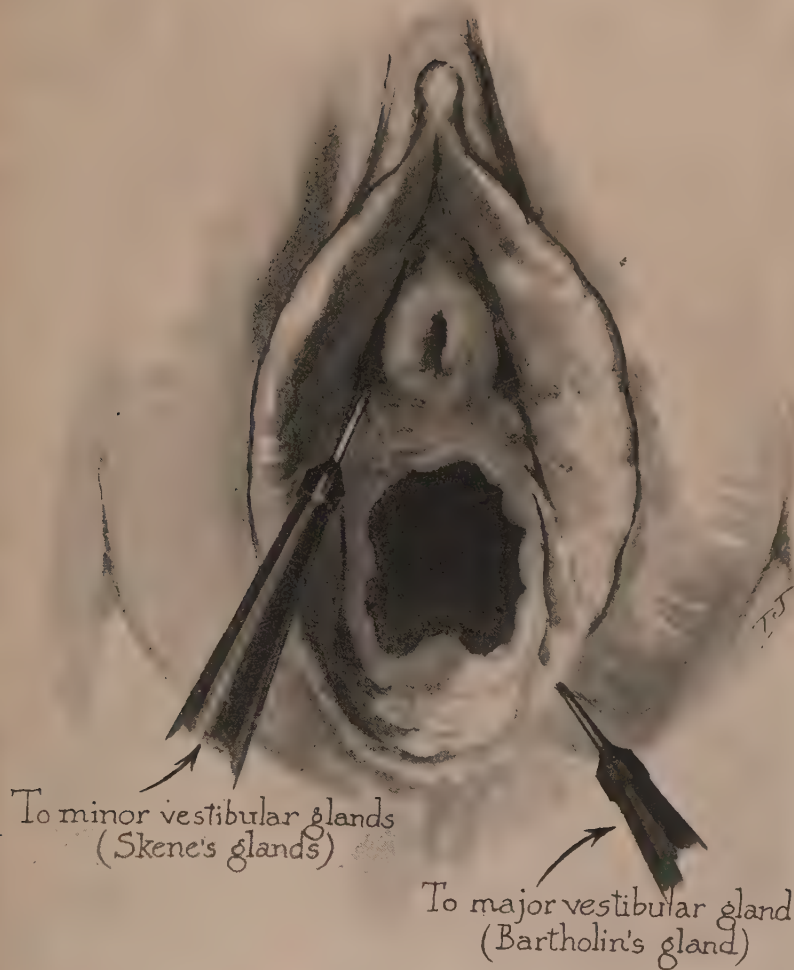


PLATE VII

Illustrating the method of applying diathermy to gonococcal infections of Skene's and Bartholin's glands.

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As a result of this treatment the entire gland is dried up and the gonococci are destroyed by heat. After four or five days there may be a very slight sloughing away of the coagulated area but, as a rule, the area is replaced by scar tissue with slight necrosis and no further treatment is necessary.

Sometimes when first seen, the infection has created a chronic periurethral abscess with a fistulous opening into the urethra.

In these cases the needle is introduced into the base of the involved area and gradually carried over toward the external meatus until a free connection has been made into the mucous membrane and lumen of the urethra. The resultant scar obliterates the area, healing by second intention, after free drainage has taken place. This method will prevent the permanent distortion of the meatus which sometimes results in marked urethral prolapse and partial incontinence.

Infection of Bartholin's Glands

Bartholin's glands are situated one on either side of the posterior commissure of the vaginal orifice. They are usually infected only by the gonococcus and then secondarily from the urethra or endocervix.

Since the initial infection takes place in the short duct of the gland, diathermy applied at this time will often prevent subsequent deeper infection of the main part of the gland. Frequently the initial infection is not noted until an abscess has formed which causes bulging and distortion of one side of the introitus.

It has been our routine to examine the duct openings frequently during the urethral and cervical treatment. In the majority of cases treated carefully by the methods described this complication will be avoided. The possibility of its development should always be borne in mind,

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and if at any time the duct area appears red or inflamed the small dessication needle should be introduced and the infectious process destroyed by heat.

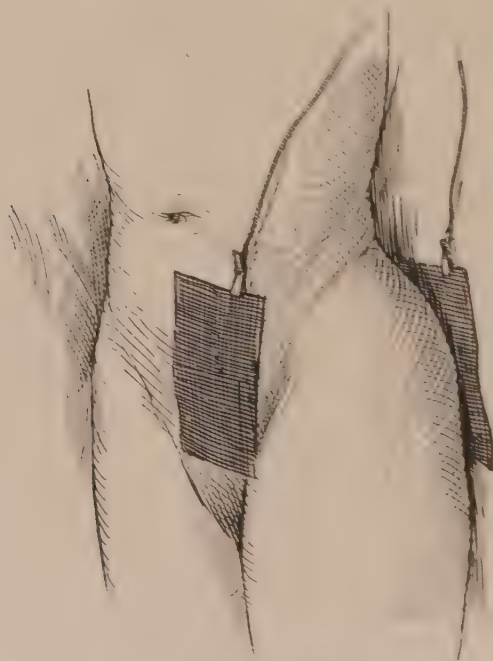


PLATE VIII

Illustrating the relative position of the electrodes in the "through and through" treatment of gonorrheal salpingitis. By having the abdominal electrode slightly smaller than the posterior electrode the heat is concentrated more nearly in the tubal region. In this illustration the posterior electrode is displaced laterally for graphic purposes.

There is no danger in this form of treatment, for if infection of the deeper structures has occurred, the dessicated tract will offer free drainage without surrounding cellulitis.

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This method is most helpful in the early or preventive treatment but if abscess formation has taken place, free incision and drainage is indicated.

It is a well known fact that after abscess formation has once taken place inflammation of Bartholin's glands is almost sure to recur if the gland is not entirely excised. Total excision in this instance is most satisfactory in producing a complete cure. The operation is not difficult or mutilating but is attended by considerable hemorrhage and is, therefore, advisedly a hospital procedure which necessitates several days in bed.

By localizing diathermic penetration into the gland area many of these cases can be speedily and completely cured without a cutting operation.

The needle electrode is inserted into the duct for a distance of one or two cm. depending upon the size of the infiltration. A very low degree of current is applied and the tip of the needle is moved successively from one part of the gland to another until the entire glandular infiltration has been subjected to the heat. An immediate shrinking and dessication of the area is accomplished but if a very low degree of current is used there is very little sloughing.

Some authors advocate the induction of heat by a round flat electrode, about the size of a silver quarter, placed in contact with the adjacent mucous membrane. This method is successful if free drainage can be obtained through the duct to the labial fold. Since the duct is practically always obliterated by the original inflammatory process we believe the former method is better.

In the rare instances where the needle method may fail total excision can be resorted to at a later date.

Salpingitis

In our earlier work we were most apprehensive in applying diathermy to tubal or pelvic inflammation. Our

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first experience, therefore, was with the more chronic cases. The excellent results obtained in these more protracted conditions finally induced us to test the value of this method in all stages of pelvic inflammation.

As has been previously stated in the consideration of endocervical infections, the preponderance of evidence at hand tends to the belief that gonorrheal infection of the Fallopian tubes is, in the majority of instances, a transitory or self-limited process insofar as the active gonococcal infection is concerned.

Experience has taught us that the focus which perpetuates chronic gonorrhea in women is most frequently in the lower genital tract and, for this reason, radical measures are rarely to be directed to the tubal condition in order that a cure may be effected.

Before proceeding in the discussion of the treatment of pelvic inflammatory disease, we wish to emphasize that we believe in strict adherence to the established principles of surgical treatment when the indications for intervention are actually present and are clearly defined. On the other hand, we feel that diathermy provides us with a method which will obviate operation in many cases which would otherwise obtain relief only by this means.

In the acute stages of tubal infection with pelvic pain, elevation of temperature and leukocytosis, it is generally agreed that palliative treatment is advisable unless gross suppuration occurs. In the latter instance, free drainage is all that is indicated. These patients should be put to bed in a slightly upright position and supportive measures instituted.

Through and through diathermy is indicated as an additional palliative measure at this time. Flat electrodes six by eight inches in size of either block tin or wire mesh are placed over the suprapubic region above and

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the sacrum below. These are thoroughly coated with shaving soap and can be placed in position without disturbing the patient in the least. Since the ideal location for this class of cases demands rest in bed, preferably in the hospital, any large portable diathermy apparatus will suit the occasion. The clinical course of the disease requires the usual careful observation. The first treatment is given for forty minutes using a maximum of 750 ma. The effects of the treatment should be distinctly beneficial. Any increase in pelvic pain or an immediate elevation of more than one degree of temperature is regarded as a contraindication for further diathermy at this time. The same principles hold true in this regard as apply to walled off suppuration elsewhere in the body. If drainage is taking place from the tubes through the cervix the results will be favorable in every case. If an appreciable degree of active parametritis is present the initial treatment will show that more prolonged palliation is necessary before deciding whether diathermy or surgery is the procedure of choice. The same holds true for tubal occlusion.

Any acute inflammation of the uterine adnexa contraindicates all intracervical or intrauterine treatment.

If the effect of the initial treatment is salutary, it should be repeated at intervals of forty-eight hours and the duration of treatment may be forty minutes. As a rule, 1000 ma. of current is the maximum used in these applications, although the tolerance of the individual is the best guide.

As pelvic or abdominal pain disappears, and the temperature and leukocyte count become normal, the intervals between treatments are lengthened. At this time careful bimanual examinations should be made repeatedly before allowing the patient to become ambulatory.

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If symptoms of active pelvic inflammation are absent for three to four weeks, the patient is then treated by the method described under endocervicitis.

The following cases are illustrative of the various phases of this type of treatment.

Case I: R. F., aged 23 years, married, gave a history indicating a gonorrheal infection of four months' duration. During the previous two months the patient had been unable to carry on her work because of severe bilateral pelvic pain which radiated into either groin and thigh. This was accentuated on walking. When she remained in bed for three or four days the pain diminished but again recurred as soon as she became active. Examination, January 22, 1924, showed a profuse purulent cervical discharge containing gonococci. Both tubes were enlarged and tender. The uterus was freely movable and there was no apparent broad ligament or parametric inflammation. Temperature 100.4° F. Through and through diathermy (500 ma.) was followed by marked relief and on January 25, 1924, her temperature was normal. After six treatments at three day intervals she was able to be about all day without discomfort. A profuse vaginal discharge persisted. On February 14, 1924, the tubes were palpably normal and deep pressure elicited no pain. Endocervical treatment was begun and repeated at six to ten day intervals for five treatments. Hot sitz baths accompanied by the insertion of the vaginal bath speculum, were the only adjunct treatment. Smears have been negative for gonococci for four months, there is now only a slight mucoid cervical discharge and there has been no pelvic pain even with menstruation.

Case II: I. D., aged 30 years, an actress, gave a history of gonorrheal infection for one year without relief from local treatment. Following a strenuous dancing act she was taken with pelvic pain, abdominal cramps and repeated chills. She was sent to the hospital and placed at rest. The abdomen was rigid and very tender in both lower quadrants. Pelvic examination disclosed two

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boggy, fluctuant masses in the fornices. Temperature 102° F., leukocyte count 14,000.

On August 5, 1922, vaginal puncture in either fornix opened into two large abscess cavities and there was profuse drainage for two weeks. During this time all symptoms disappeared except a persistent dull pain in the entire lower abdomen. Vaginal examination revealed two hard, indurated appendages which were extremely tender on palpation. Through and through diathermy treatments were given every second day for two weeks. All discomfort having disappeared, the patient was allowed to leave the hospital. Two weeks later the uterus was freely movable and there was no pain on bimanual examination. Examination of the cervical discharge showed much pus and many gonococci. The patient had three endocervical treatments a week apart. On September 13, 1922, cervical discharge was absent and the tubes were not palpable. On April 9, 1924, she reappeared stating that she was perfectly well and had had no further treatment. At this time examination showed no gonococci in the scant cervical discharge and there was no palpable evidence of pelvic pathology. On May 12, 1924, careful examination revealed no evidence of infection.

Case III: M. R., single, aged 26 years, gave a history of pelvic inflammation accompanied by profuse vaginal discharge for six months. Two days prior to examination menstruation had begun and was accompanied by such severe pain that the patient was confined to her bed. On April 6, 1923, she was barely able to walk and had been vomiting for three days. Examination showed a slight abdominal rigidity with marked pain on deep pressure. Both appendages were enlarged, soft and tender. Cervical secretion was scanty but contained gonococci. The patient refused to go to the hospital as advised. Through and through diathermy for forty minutes (750 ma.) was followed by marked relief from pain and malaise. This was repeated eight times at three day intervals with complete relief. On May 15, 1923, the uterus was freely movable and the tubes were normal in size and not tender. Four endocervical treatments were given once a week and repeated examinations

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for four months failed to discover gonococci in the cervical secretion. On March 3, 1924, complete pelvic examination was normal. The patient stated that she had been married for four months without evidence of infection in herself or her husband.

Case IV: M. D., aged 23 years, married, was referred on January 7, 1924. History indicated pelvic inflammation for the past eight months. Six months previously she had been operated upon and had been told that the right tube and ovary were infected, necessitating removal. When first examined there was slight pain in either lower quadrant on deep palpation, a scant cervical discharge containing gonococci, and bimanual examination revealed two large tender tubes. There was no evidence of pelvic cellulitis and the uterus was freely movable.

Through and through diathermy for forty minutes (1000 ma.) was given twice a week for three weeks. The right-sided pain disappeared entirely after the second treatment but on the left there was even more pain than before. Vaginal examination at this time revealed a small soft right tube which was not painful but the left tube was enlarged, tender and apparently fixed posteriorly. The left-sided pain increased in severity and radiated into the left groin and thigh, making walking unbearable. Operation was considered unfavorably by the patient because she believed the right tube had been removed, despite the clinical evidence of its presence, and she dreaded the idea of complete sterility. The pain persisted and operation on March 24, 1924, showed a normal right tube and ovary but an enlarged, nodular, partially obliterated pyosalpinx with marked isthmusica nodosa. Following excision the patient has remained absolutely free from pain and the endocervical condition responded to five treatments.

This case is cited to show what may be expected of diathermy. The right tube (which had not been removed) permitted free drainage and quickly responded to treatment. The left tube did not drain freely and diathermy was of no aid in clearing up the subacute inflammation.

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Case V: V. W., aged 21 years, married, gave a history of a marital gonorrhea of three weeks' duration. On December 2, 1924, she presented herself with a temperature of 102° F., extreme abdominal pelvic pain accompanied by nausea, vomiting and general malaise. There was a profuse vaginal discharge containing gonococci and gonorrheal pus from the urethra as well. Vaginal examination showed two large palpable and tender pyosalpinges which were fluctuant. The patient was put to bed in the hospital and palliative measures instituted. On the fifth day her pain was unabated. Through and through diathermy was begun and marked relief obtained in the next forty-eight hours. Vaginal discharge was profuse and the temperature fell to normal. During the next three weeks she received a forty minute treatment every second or third day. At the end of this time she felt perfectly well and on vaginal examination the tubes could not be felt. There was no pain on bimanual pressure. Three weeks later endocervical and urethral treatments were begun and continued alternately for five weeks.

The vaginal discharge changed to a thin watery character and on March 1, 1924, the patient had been apparently free of gonococci for one month. On June 1, 1924, she wrote that she is entirely well and that repeated smears have been negative for gonococci.

Chronic salpingitis gives uniformly good results when treated by diathermy alone. Increased vascularity and free drainage undoubtedly account for these results rather than the direct bactericidal effect. We make this assertion because it is our opinion that in the majority of these cases the gonococcus is either greatly attenuated or entirely absent and the persisting infection is a secondary pyogenic one. As has been pointed out before, the staphylococcus, streptococcus, colon bacillus, etc., are less vulnerable to heat than the gonococcus. In a series of thirty-five tabulated cases we have obtained complete relief without resorting to surgical measures in a single

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instance. In these cases through and through diathermy is alternated with endocervical applications. In the latter a condenser couch is used as the inactive electrode.

Diathermy when used indiscriminately is not free from the possibility of complications and careful clinical scrutiny is necessary to decide when it will be of real value and when it should not be used at all.

CHAPTER FOUR

DIATHERMY IN PELVIC CONDITIONS OTHER THAN GONORRHEA

Non-specific Cervicitis and Endocervicitis

Infections of the cervix and cervical mucous membrane, due to bacteria other than the gonococcus, are very common. There is usually erosion of the cervix and associated glandular hyperplasia with surrounding stroma infiltration.

These erosions are most frequently the result of lacerations from childbirth but they are also found in virgins and nullipara. It is probable that in the latter they are due to abnormal mechanical irritation although the resultant leukorrheal discharge is sometimes present, without apparent reason, in conjunction with debilitating diseases.

As a rule, these patients complain of a persistent discharge from the vagina, sometimes associated with irritation of the labia and perineum.

The cervical thermophore has been of great aid in lessening the endocervical discharge in a number of these cases. The discharge changes very rapidly to a thin, watery character and cervical erosions rapidly heal. Since the majority of the organisms causing these infections are not as vulnerable to heat as the gonococcus, the end results are less satisfactory than when directed to this organism.

Our present method of treating these persistent infections combines the use of endocervical diathermy and topical applications to the endocervix and cervix.

Following a thirty minute diathermy treatment, swabs saturated in 2 per cent mercurochrome-220 solution are

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applied to the cervical canal for ten minutes. A tampon saturated with the same solution is then placed in apposition with the cervix and retained for six hours.

Results are obtained far more rapidly when the above technic is followed than when topical applications are used alone.

In these cases any other efficient antiseptic solution may be successfully used in conjunction with diathermy.

Dysmenorrhea

Our interest in the effect of diathermy on painful menstruation came about quite accidentally. Following treatment for endocervicitis many patients, whose menstrual pain had antedated their specific infection, announced that they no longer suffered any pelvic pain at these periods. Since a number of these women had had previous cervical dilatation and endocervical applications without relief of dysmenorrhea, their statements seemed to indicate that relief was due to more than the mechanical measures employed.

A brief review of the literature on this subject is interesting. Turrell⁸ says, "diathermy will give immediate and lasting relief in most acute cases of dysmenorrhea." Sloan⁹ recommends diathermy on the autocondensation couch for functional or spasmodic dysmenorrhea.

Kelly¹⁰ states, "the treatment of dysmenorrhea by means of electricity was a subject of much interest some fifteen years ago and promised to yield most excellent results, according to good authorities. The method has failed to fulfill its early promise, not because it has proved untrustworthy, but because there has been a general failure of interest in the question of the use of electricity in gynecology. It seems a matter for regret, however, that the electrical treatment of various gynecological affections should not receive more attention."

OTHER PELVIC CONDITIONS

In several young girls we have successfully used diathermy in the treatment of dysmenorrhea, without subjecting them to vaginal examination. Abdomino-dorsal heating through of the entire pelvis with from 800 to 1200 ma. for thirty minutes constituted the treatment. This is best given during the week prior to menstruation. In many instances it hastens the flow a day or two but without untoward symptoms.

In married women we use the same technic previously described in treating endocervical infection. If it seems desirable to administer diathermy during the first day of the period, transpelvic applications can be given.

In this connection it is obvious that dysmenorrhea due to a definite pelvic pathological condition, or to generalized debilitating disease, will not be permanently relieved by diathermy alone.

The benefits which may be derived from diathermy in this condition have been summarized as follows: Dilation of the vessels, relaxation of spasm and inhibition of tone, improvement in blood supply and consequent improvement in nutrition and growth.

Pelvic Adhesions

Diathermy is valuable in the treatment of pelvic adhesions following a plastic peritonitis. It should be reserved for those cases in which there is no active sepsis and should be induced directly through the area in which discomfort persists.

CHAPTER FIVE

GONORRHEA IN THE MALE

The application of heat as a therapeutic measure in the treatment of Neisserian infections in the male is not new. Heat applied to an arthritis of gonorrheal origin has long been an accepted and valuable procedure.

The different forms of psychrophores designed for urethral and rectal application of heat and cold are familiar instruments in the armamentarium of many surgeons.

In 1913 Fulton¹¹ called attention to the use of heat applied to the urethra by running hot water through a modified psychrophore. This instrument had thermometers attached so that a definite temperature could be maintained within the urethra. The results in a small number of cases were excellent, but his instrument was too cumbersome.

Vorner¹² tried curing gonorrhea in a similar way, but heated his "double sound" by a mignon lamp. In order to solve the problem in a different way, Weiss¹³ kept the patient in a hot bath until the entire body was raised to the required fever temperature. In this way he artificially induced fever. In eleven cases of recent gonorrhea, he had the patient take hot baths for periods of forty to forty-five minutes during which time the temperature of the water was gradually increased from 104° F. (40° C.) to 110° F. (43.5° C.). In one case, the body temperature was raised to 108° F. (42.6° C.) in a forty minute bath, and at once the gonococci entirely disappeared from the urethral discharge.

Many workers have tried to elaborate on the psychrophore. Others, including one of us (Corbus), have tried

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to construct a heated sound. The latter instrument has been quite popular among the German urologists. The reports published by Frank,¹⁴ Rost,¹⁵ Kyaw,¹⁶ and Scharff¹⁷ are interesting.

In order to determine the effect of different degrees of heat on the mucous membrane, Santos¹⁸ inserted the positive electrode into the urethra of dogs and heated the instrument to 113° F. (45° C.) for one hour. No distress was apparent during the entire treatment. The dogs were sacrificed after eight days, and grossly, the urethra showed no abnormality. In comparing the heated and unheated segments microscopically there was merely an epithelial desquamation in the heated portion.

Santos¹⁹ further experimented upon himself and others. He states that up to 109° F. (43° C.) nothing abnormal is felt within the urethra but starting at 109.4° F. (43° C.) there is a gradual sensation of warmth and this is increased to a point of intolerance at 114.8° F. (46° C.). He has kept the urethra heated to 113° F. (45° C.) for one hour without the slightest tissue destruction.

Roucaÿrol²⁰ has experimented extensively with diathermy in the treatment of acute and chronic urethritis of gonorrheal origin. He is most enthusiastic over the favorable results obtained by this method.

Castano²¹ and Gomez report conflicting experiences with destruction of the gonococcus by diathermy. In some instances the rapidity of cure was amazing, while in others treated by an identical technic there was no relief. They conclude, however, that diathermy is the most valuable adjuvant in the treatment of gonorrhea and its complications.

Serés²² states that diathermy is superior to all other methods of treatment for destroying the gonococci in the prostate, posterior urethra, and glands of Littre. In

his experience it is also effective in recent cases, a complete cure in many instances being obtained by two or three treatments.

K. M. Walker²³ says, "Diathermy on the whole has given very satisfactory results in the treatment of chronic gonorrheal prostatitis and rheumatism."

According to David Watson,²⁴ "in acute vesiculitis diathermy is perhaps the most useful of all modes of treatment."

H. Schmidt,²⁵ after a prolonged trial of diathermy in the treatment of all stages of gonorrhea in the male, limits his endeavors with this method to "stubborn prostatitis, narrow strictures and muscular and articular rheumatism."

Canovas²⁶ reports a series of seventy-three patients with gonorrheal epididymitis treated by him at the Madrid Military Hospital. He concludes: "Diathermy is the ideal curative procedure for acute, subacute and chronic orchitis and epididymitis."

Cumberbatch and Robinson²⁷ report excellent results from diathermy in gonorrheal arthritis, epididymitis and prostatitis.

Simmonds²⁸ reports eleven cases of chronic gonorrheal prostatitis cured by diathermy when other measures had failed.

Nagelschmidt,²⁹ with reference to the male urethra, states: "Theoretically, it would be easy to apply heat deeply with diathermy but practically it is quite different. In order to obtain an even, deep heat, one must apply diathermy with low amperage during a long time. It is technically very difficult to diatherminize the whole urethra far into the bladder without heating up some places too high. In the pars pendula no difficulties appear. As soon as we reach the root of the penis, it is impossible without special technic to heat through the urethra in all directions with an even temperature."

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"In 1912, Dr. Santos commenced research work in my institution assisted by Siemens and Halske and finally succeeded in heating through the entire urethra up to the bladder by means of an urethral sound electrode, and in this way cured gonorrhea in one treatment. But in order to bring about a sure sterilization of the gonococci we must reach a temperature of 45° C. (113° F.) for more than thirty minutes. Such a temperature means the limit of tolerance of the mucosa and besides it is very difficult to heat evenly through the entire urethra in all directions. The urethra has in different sections different calibre; the mucous membrane sometimes lies flat on the electrode, sometimes in creases. In many places we apply our heat upon thin membranes, in other places application is upon deep reaching glandular ducts, pockets, etc. Finally, even with the most complicated and ingenious apparatus it is almost impossible to keep the high temperature constant. On account of all these difficulties, this way of treating gonorrhea with diathermy has been abandoned, especially because the results are not always sure."

There are other references to the application of heat in the treatment of gonorrhea in the male but the foregoing will suffice to give a somewhat general consideration of the problems involved and the difficulties attendant upon the development of any ideal, or universally applicable, technic.

After due deliberation we have decided to discuss briefly only the methods which have met with undoubted success in treating gonorrhea in the male. Many misleading and enthusiastic statements have been broadcast to the medical profession on the ease with which gonorrhea in the male can be cured by diathermy. It should suffice to state that after six years of active clinical investigation on this subject we have no successfully standardized method applicable to all phases of gonorrheal

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infection in the male. It is our firm belief that ultimately the technical difficulties, which have so far prevented the absolute perfection of this method, will be solved.

Acute Anterior Urethritis *Diathermy Alone*

In a patient presenting himself during the first seventy-two hours of an acute urethral infection, diathermy may aid in effecting a speedy cure. In these individuals the following routine is established: Gonococci are definitely identified by the Gram stain. The first glass of voided urine may be clear, containing shreds and debris, or it may be diffusely turbid. The second glass should contain clear urine.

The patient is placed upon an autocondensation couch and the penis is held on a slight stretch parallel to the long axis of the body; the meatus is sterilized and the foreskin retracted; the sterile urethral electrode is lubricated and passed gently into the urethra for a distance of 3.0 cm. The thermophore is then held firmly in place by a special holder to which the penis is fastened by a strip of adhesive tape. In the absence of a holder an ordinary laboratory ring stand may be used. The position of the patient should be absolutely comfortable so that he may relax completely. The current is gradually advanced until the thermometer registers a temperature of 110° F. (43.5° C.). At this point it is stabilized for forty minutes. The current is then gradually reduced until it is completely turned off and the thermophore is withdrawn. The instrument is then adjusted so that the active electrode surface corresponds with the estimated length of the anterior urethra in the individual under treatment. The penis is then suspended in an oblique position and the electrode is passed down to the triangular ligament. The current is again advanced until the

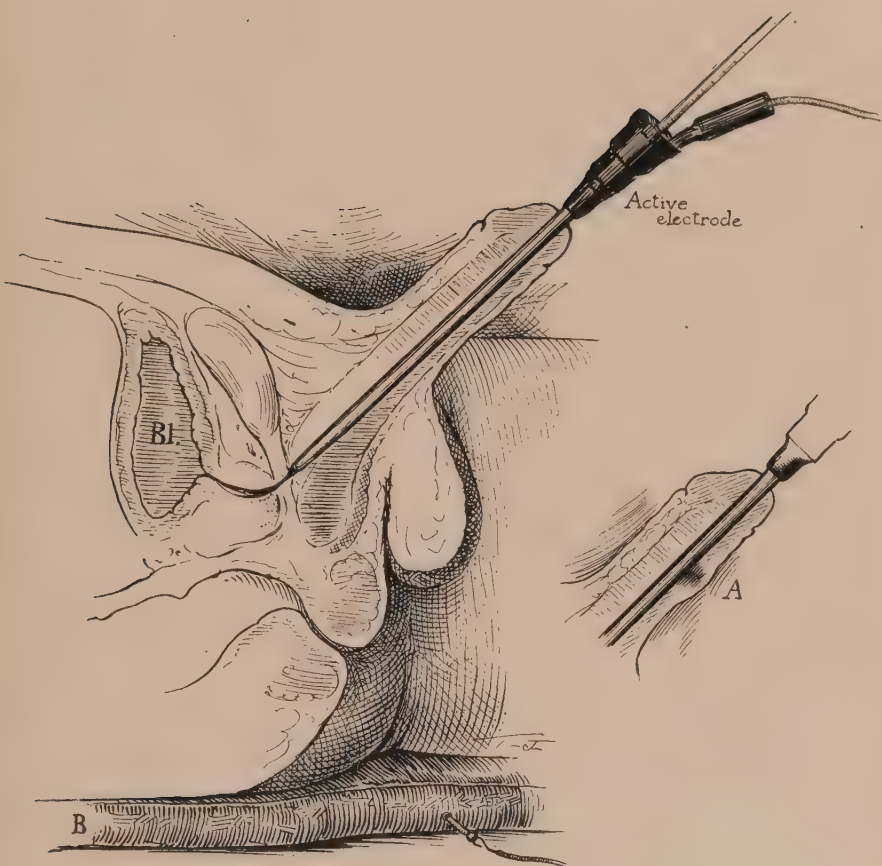


PLATE IX

Illustrating the thermophore as applied to the anterior urethra of the male. Insert *A* shows the treatment of peri-urethritis. At times it is advantageous to place a flat electrode over the ventral surface of the penis (at region *A*) so that the heat may be localized directly in the infected region. In applying heat to the anterior urethra in gonorrheal urethritis, we believe the auto-condensation couch, as the inactive electrode, is preferable.

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thermometer registers 110° F. (43.5° C.), and is again maintained for forty minutes.

Contrary to the general impression of this form of treatment it is painless during the period of application. After the withdrawal of the thermophore there is a copious discharge of serum and mucus which lasts until the next urination.

The patient is encouraged to drink large quantities of water but no other local treatment is given. In six hours the entire anterior urethra is again subjected to a forty minute heat treatment at 110° F.

If gonococci are present on the following day two more urethral treatments are given. If no gonococci are found the urethra is not treated but successive smears are carefully examined for their presence. If they fail to appear after three days, an anterior injection of one-half of one per cent silver nitrate solution is retained for one or two minutes. If successive smears remain negative for one week the accepted methods for determining a cure are applied.

Peri-Urethritis

Not infrequently a patient presents himself with a marked periurethral infiltration which has occurred during the active treatment of an acute anterior urethritis.

Frequently this extension of suppuration to the periurethral connective tissue has been due to over-treatment of the acutely inflamed anterior urethra with too drastic local antiseptics. Occasionally, however, it occurs in the absence of excessive or untimely treatment.

The successful management of these periurethral infiltrations is most important because a large percentage of them undergo continued suppuration and a periurethral abscess results. Many of the latter are followed by troublesome urethral fistulae.

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We have been most successful in destroying the gonococcus and in bringing about transurethral drainage in these conditions by applying diathermy with the urethral thermophore. This can be used alone with the indifferent electrode above the symphysis pubis or in combination with a small flat electrode about one inch wide by two inches long immediately below the infected follicle. Frequently we have been successful in destroying the local infection by using two electrodes of the same size one inch by two inches immediately above and below the infected gland. These must be soaped well with shaving soap and strapped to the parts by adhesive tape. This does not hold true if frank suppuration has already taken place and the area is definitely fluctuant on palpation. When abscess formation has already taken place it is necessary to incise the area externally. Diathermy may then be applied within the urethra with excellent results.

Folliculitis

Minute retention abscesses of suppurating urethral glands are not infrequent during the course of a severe acute urethritis. The majority of these, sooner or later, drain into the urethra when the acute obstruction in the ducts has been eliminated. Many of these infected follicles, however, persist for some time and, since they are inaccessible to local medication, act as a focus for dissemination of gonococci along the course of the urethra. In the acute stages these areas are rarely palpable but frequently the patient can designate certain areas throughout the course of the penile urethra which feel uneasy and sensitive. (See Plate VIII-A—page 58.)

In the more chronic stages these follicles may be palpated as indurated, shot-like bodies in the urethral wall.

Diathermy is most expedient in establishing free drainage in these obstructed glands. The localization of heat in the occluded duct appears to relieve the inflammatory

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swelling and open the lumen for the passage of the infected gland content as well as acting as a specific for the gonococci.

Many urologists are most enthusiastic concerning the "fulguration" treatment of persistent urethral folliculitis. Swinburne³⁰ advises direct destruction of these areas with the monopolar current applied through a direct vision water urethroscope. We believe that by using the urethral thermophore, as outlined above, this more drastic method will be unnecessary and the results will be even more favorable.

Stricture of the Urethra

Progressive urethral dilatation, when possible, is the time-honored and successful method of treating the cicatrices, scars and infiltrations which cause a narrowing of the urethral lumen.

An analysis of the exact physiological mechanism which is brought into play in effecting the dilatation of a urethral stricture is most interesting. That the resorption of scar tissue is not entirely due to the mechanical stretching must be self-evident to all those who have had an extensive experience in this type of therapy.

Quoting from Frank,¹⁴ "The autodigestion is not only brought about by ferments liberated by the leukocytes, the so-called 'autolysins,' but also the mere inflammatory hyperemia plays an equal role. As evidence of this Bier took the position that dilatation of urethral strictures was not caused purely by the mechanical action of the instrument but that the sounds caused an inflammatory irritation. A considerable leukocytosis arose and the ferments of these leukocytes had a tissue dissolving and melting influence. The so-called La Fort procedure of handling strictures which are very difficult of passage rests entire-

ly on this fact. It is also possible to have a solution of the connective tissue part through the hyperemia alone."

The utilization of heat in the treatment of various infiltrative disease processes of the urethral mucosa, and especially strictures, has been in vogue for many years. Over sixty years ago the Hungarian hussars treated gonorrheal inflammations of the urethra by placing the penis between two hot tiles and keeping it there as long as possible.

Kovacs (cf. Frank) recommended, that previous to the dilatation treatment of very hard and narrow strictures, hot compresses should be applied for several days to diminish the rigidity of the tissues.

In more modern times urologists frequently advise their patients to take repeated and prolonged hot sitz baths preliminary to the attempt to pass a very narrow urethral stricture.

It would be too time-consuming, as well as largely a matter of repetition, to try to enumerate the various methods which have been devised to use heat in aiding mechanical dilatation of the urethra. It is obvious that any method which will induce heat into the urethral wall results in making the strictured area more easily passable, and more readily dilatable by mechanical means.

Two types of urethral electrodes are used to infuse heat into the cicatricial portions of the urethra. Flexible bougies may be used for the more narrow strictures, and steel or other metal instruments for those of larger caliber.

It is desirable to establish the exact size of the narrowest constriction by the passage of various sized filiforms or preferably, when possible, by the *bougie a boule*. When the exact calibration is established a flexible or metal instrument is slipped through the stricture area and held securely in position. A urethral thermophore with

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included thermometer is preferred because of the accuracy of temperature control. In these cases we also have the patient recline upon the autocondensation pad so that there will be a general distribution of heat about the entire length of the urethral electrode. It is not necessary to approach the limit of heat tolerance of the urethra in bringing about the relaxation of the constriction. A temperature approximating 105 to 107° F. (40.5 to 41.6° C.) will usually suffice.

At the conclusion of the heat treatment an instrument of larger size may be very gently passed throughout the entire length of the urethra. Progressive dilatation is then continued either with or without preceding diathermy treatments.

Gonorrheal Prostatitis, Prostatic Abscess and Seminal Vesiculitis

In the treatment of the foregoing conditions it must be distinctly understood that a complete history has been obtained and an absolute diagnosis concluded.

Believing that no one will attempt the application of any therapeutic measure without previously making an exact diagnosis, the authors sincerely hope that if any additional information is desired on the symptoms and diagnosis of the above conditions, textbooks on genito-urinary diseases will be consulted.

In drawing an arbitrary division between acute prostatitis and abscess, we must bear in mind that all such cases represent retention of pus within the prostatic ducts, and any one of them may progress to unmistakable abscess formation.

The application of heat either by means of sitz baths or the rectal psychrophore are time-honored methods of treating infections of the prostate and seminal vesicles. In other chapters the effect of heat on the gonococcus has been described in detail. No other method has been

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so successful in decreasing inflammation and reducing congestion.

From our clinical experience we believe that *heat*, as applied by medical diathermy, will destroy the gonococcus and when it is localized, as in gonorrheal prostatitis, prostatic abscess and seminal vesiculitis, its therapeutic possibilities are absolutely specific.

Rectal Thermophore

The rectal thermophore is made of rubber and is seven inches long. The distal end is concave and in it is placed the active electrode corresponding to the convexity of

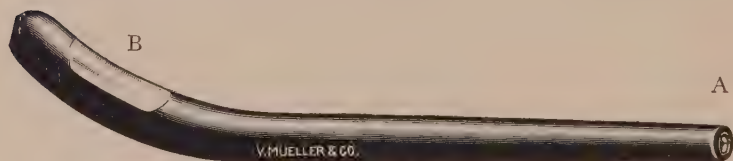


PLATE X

The Corbus Rectal Thermophore. *A*, Point of connection.
B, Point of contact.

the prostatic surface. Fig. B shows the metal plate. Fig. A shows the point of contact for connection to the diathermy instrument.

Technic

The patient may be placed in the dorsal position or he may lie upon his side. In either event, the knees are held slightly flexed. The inactive electrode made of block tin or wire mesh, four by five inches in size, is thickly coated with shaving soap and placed over the suprapubic region. More recently we have used the autocondensation couch as the inactive electrode. A careful rectal examination is made and the localization of the active process identified. The rectal thermophore

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is lubricated with vaseline and slowly inserted in such a manner that the exposed metal surface is held in direct contact with the point of greatest tenderness. The thermophore is then held firmly in position by the metal

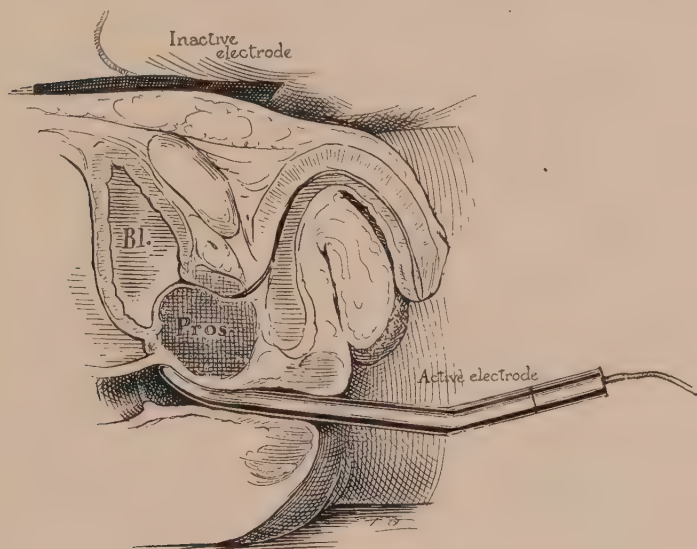


PLATE XI

Illustrating the application of the rectal thermophore.

holder which rests upon the table. The current is advanced slowly to a point just below the tolerance of the individual. The average duration of the treatment is thirty or forty minutes. At no time should there be a painful sensation other than the slight tenesmus due to the anal distention.

We have had several rectal thermophores constructed with thermometer built into the shaft but as yet have not obtained one which registers accurately enough to guide us in the exact degree of heat desired.

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The following case is illustrative of the beneficial effects of this type of treatment.

An acrobatic dancer, aged 23 years, presented himself for examination and treatment. His chief complaint was frequency of urination associated with severe urgency and tenesmus. There was a persistent, dull aching pain in the perineum and rectum. There was a purulent urethral discharge containing gonococci and both glasses of voided urine were turbid. Rectal examination showed the right prostatic lobe to be boggy, and extremely tender with moderate fluctuation. The rectal thermophore was used to direct diathermy for a period of thirty-five minutes. There was no relief from this treatment for the next sixteen hours but after this time there was a complete cessation of all symptoms, and five days later gentle rectal massage was well tolerated. The fluctuation had disappeared and free drainage followed massage. Appropriate treatment was continued from this time on. The interesting feature of this case was that the patient at no time discontinued his professional dancing even though on first examination a prostatic abscess, which might demand surgical treatment, seemed imminent.

Epididymitis

Gonorrheal epididymitis occurs in from 20 to 30 per cent of all cases of gonorrhea. It is more prevalent in dispensary than in private practice. This painful and destructive complication, in an economic way alone, represents the sum total of time lost in 90 per cent of the cases of specific urethritis.

During the past seventeen years the management of this condition has received serious and more detailed consideration from urologists in general but particularly from American urologists. This was largely stimulated by the work of Hagner, Bazet and Belfield.

The time-honored method of treating this class of cases by elevation or strapping of the testes, rest in bed and the external application of heat or cold, incapacitates

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the patient for from five to fourteen days and may later necessitate operation to drain the infected epididymis.

The interest in this troublesome situation, from a surgical point of view, has become so keen that few patients escape the procedure of epididymotomy. This is not only true of patients in private practice but in most dispensaries as well. The results of this operation, in a large proportion of cases, have been excellent but the patient must be laid up at least three to ten days.

While the outcome of an individual case of gonorrheal epididymitis is rarely in doubt, the disability which ac-

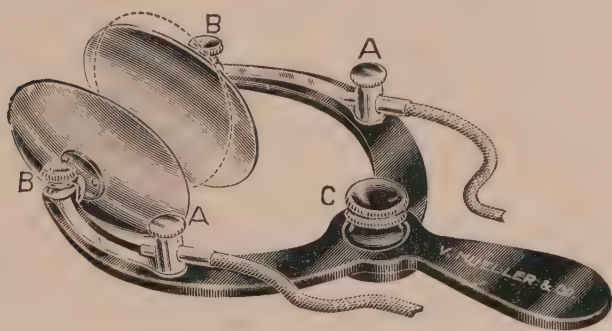


PLATE XII

The Corbus Scrotal Thermophore.

companies the usual methods of treatment is extremely annoying and embarrassing both physically and financially.

It is apparent that any method which can abort the attack, or stop the pain and absolutely eliminate the usual incapacity, would be a decided step forward in this type of therapy.

Knowing that the gonococcus is instantly destroyed at a temperature of 108° F. (42.5° C.), it occurred to us that if a suitable instrument could be devised we could induce sufficient heat within the body of the epididymis

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to destroy the gonococcus in its local invasion, stop the pain and abort the attack.

Description of Instrument

The instrument consists of a fiber clamp with curved arms, one of which is movable. This movable arm may be fastened at any desired point by means of a lock-nut (c). Two concave discs (b) are attached to the distal

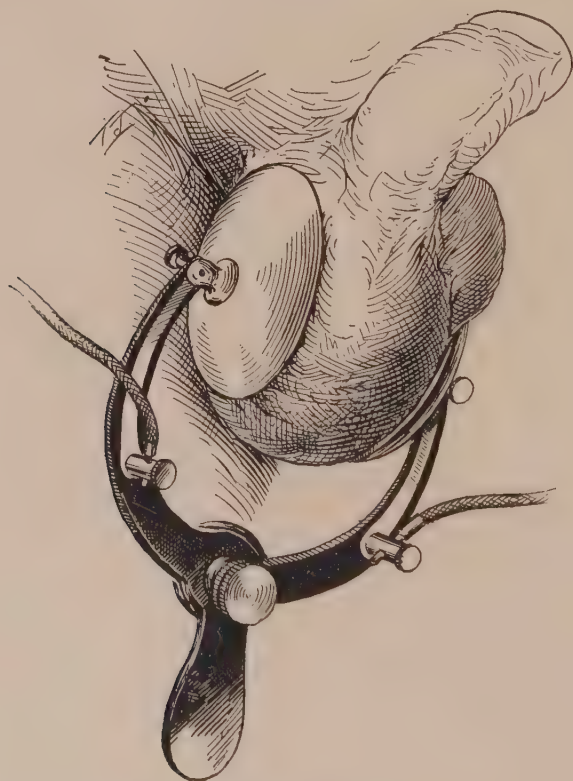


PLATE XIII

Shows the enlarged epididymis and accompanying oclitis (exaggerated). The two poles are placed so as to enable the heat to pass directly between the globus major and minor.

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ends of the arms. These discs measure 4 cm. in width and 5 cm. in length, and are swiveled that they may be easily adjusted. Each disc is connected to a binding post (A) so bipolar current may be applied. The electrode is rigidly constructed, and due to the self-adjusting discs, is applicable to any sized scrotal content.

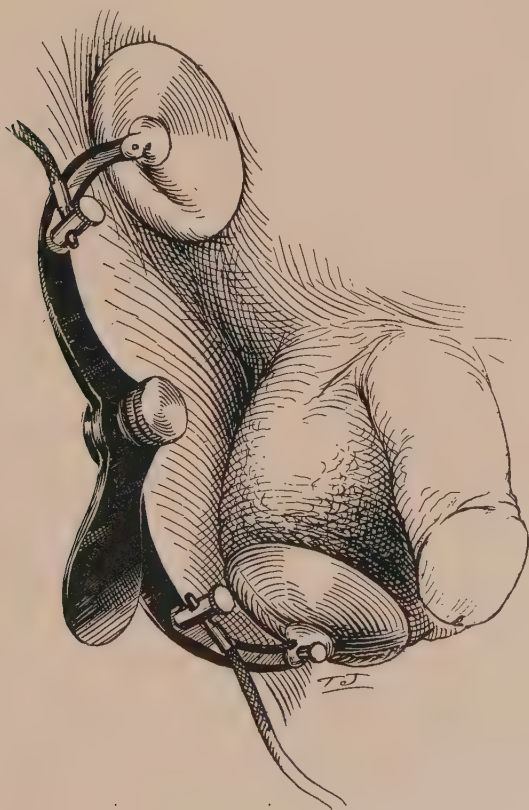


PLATE XIV

Shows the treatment as applied to the lower pole and the vas as it emerges from the external ring.

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Method of Application

The patient is placed in the recumbent position and the scrotal and suprapubic region exposed. The electrodes are thickly coated with shaving cream and the entire body of the testis and epididymis is encased between the apposed electrode surfaces and heated uniformly by the d'Arsonval current. In order to effect the greatest degree of heat induction possible in the individual, the current is increased to the extent of cutaneous discomfort. When this point is reached the current is then reduced slightly so that no unpleasant sensation accompanies the treatment. Our routine has been to apply the heat for at least forty minutes, since even at 104° F. to 106° F. (40° C to 41.5° C.) the gonococcus is killed during this time. In those cases seen during the first twelve to twenty-four hours of epididymal involvement by the gonococcus one such treatment has usually sufficed to check the attack and start the process of resolution. In those instances where the inflammatory reaction has been present for a number of days, three or four treatments on successive days have been sufficient to eliminate all untoward effects.

A very distressing funiculitis often accompanies the epididymal involvement and may persist after the symptoms of the latter have completely subsided. This is as quickly relieved by placing the instrument in a vertical position with one electrode over the globus minor and the other over the region of the internal abdominal ring. This permits an induction of heat throughout the accessible portion of the vas deferens, and should be continued for forty minutes.

So mild is the attending inflammatory reaction following a heat treatment for gonorrheal epididymitis, that there is absolutely no hydrocele present. Both poles of the epididymis are distinctly palpable as hard painless

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nodules. This is rendered more distinct on account of the absence of any orchitis.

A Few Typical Case Reports Are Quoted

Case I: R., aged 35 years, during the course of an acute urethritis motored several hundred miles in one day. That night his right epididymis became very tender and enlarged gradually. The next morning, August 2, 1923, when he presented himself the entire epididymis was swollen to five times normal size. There was slight accumulation of hydrocele fluid, temperature 101° F., pulse 110, leukocyte count 13,500. The patient was very weak and could hardly walk so great was the pain in the right testis and groin. It was imperative to his business interests not to be laid up that week because of a local convention. Diathermy for forty-five minutes was followed by complete relief from local pain. The following day the patient felt perfectly well. There was no local pain or tenderness although the lower pole of the epididymis was three times the normal diameter and very hard. The patient had no further discomfort and five days later his scrotal content seemed normal.

Case II: H., aged 23 years, professional dancer developed a left gonorrheal epididymitis in the fifth week of an acute urethral infection. He presented himself October 10, 1923. The left scrotum was red and swollen to twice the normal size. The lower pole of the left epididymis was markedly swollen and so tender that palpation caused severe prostration. There was very slight hydrocele present. Temperature 100° F., pulse rapid. Diathermy for one hour gave marked relief. The patient was very anxious to avoid prolonged absence from the stage but was advised to remain in bed for the following twenty-four hours. A similar diathermy treatment was given the following day and complete subsidence of all pain, swelling and tenderness was noted on the second day. In spite of repeated warnings the patient persisted in doing his acrobatic dancing stunts for an aggregate of thirty minutes each day. The scrotal content was kept elevated by an elastic supporter. No recurrence took place and five days later both testis and epididymis were normal. The patient lost only one day of work.

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Case III: P., aged 22 years, presented himself October 1, 1923, with a left gonorrheal epididymitis of three weeks' duration. Rest in bed, hot applications and tight suspensories had failed to do more than temporarily relieve the pain and swelling. The epididymis was twice normal size, hard and painful on palpation. The vas deferens was half again as large as normal and was tender as far up as the external inguinal ring. Walking even with a well-fitting suspensory, was attended with a sickening pain in the left testis and groin. Diathermy for one hour gave no apparent immediate relief. Twenty-four hours later the pain left the epididymis completely and the patient declared on the third day that there was absolutely no discomfort. The acute swelling had entirely subsided four days later and there has been no recurrence.

These three cases are typical of the results obtained in a series large enough to justify our enthusiasm as to the specificity of diathermy for gonorrheal epididymitis.

Diathermy provides us with a method of inducing heat within the body of the epididymis, testis and spermatic cord. By using the electrode described above, the gonococcus can be rapidly destroyed in its local invasion obviating prolonged inactivity or operative interference. Our results with this original method have been so uniformly satisfactory that we feel free to describe it as one which is specific for gonorrheal epididymitis.

Gonorrheal Arthritis

Gonorrheal arthritis is the most frequent type of metastatic gonorrhea. Almost any joint in the body may be affected and frequently the involvement is multiple. There is often present an accompanying synovitis, tenosynovitis, or bursitis.

The knee joint is most frequently involved but infection of the metatarsal, ankle, wrist, elbow, hip, and shoulder joints also occur and are more frequent in the order given.

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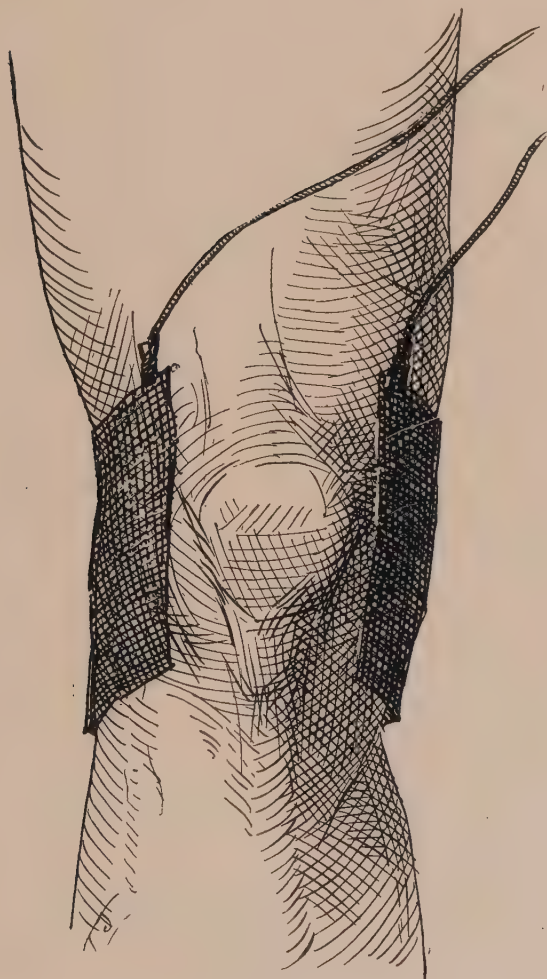


PLATE XV

Shows position of electrodes as applied to the knee in the treatment of gonorrheal arthritis. By having the electrodes of equal size the maximum heat concentration is within the knee joint.

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If gonorrheal arthritis occurs during the course of an acute gonorrhea there is no difficulty in establishing the correct diagnosis. We wish to emphasize, however, that many chronically inflamed joints are diagnosed as "chronic gonorrheal arthritides" and as such are treated with diathermy with varying degrees of success. We agree with Nathan⁸¹ that "gonorrheal arthritis may be recurrent but it is not strictly speaking chronic." "When such a condition is chronic it is the result of adhesions and structural changes remaining as the result of previous acute gonorrheal inflammation."

In gonorrheal arthritis the complement fixation test on the blood is always positive if properly performed. In the absence of a positive test, and with negative smears and cultural findings from the genito-urinary tract, we must conclude that active gonorrheal infection does not exist.

Diathermy is not a "cure-all" for all types of arthritis. It is a distinct sedative for any inflamed joint but, owing to the vulnerability of the gonococcus to heat, it is an absolute specific for gonorrheal arthritis. It acts by destroying the gonococcus *in situ* but it will not be productive of permanent results until its primary localization is eliminated. In the latter instance the persistent focus in the male is most often in the prostate and seminal vesicle.

Frequently a septic infection from the teeth or tonsils is disregarded because the patient gives a history of a previous gonorrhea and this evidence is unduly magnified as the possible etiological factor of an acute arthritis.

If we are to be successful in the treatment of gonorrheal arthritis we must be absolutely sure of the diagnosis.

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Technic of Application

For the application of diathermy to gonorrheal arthritis it is best to employ the wire mesh electrodes, although pliable blocks of tin may be used over the larger joint surfaces with equal success. The electrodes should be of equal size unless it is desired to localize the heat production nearer one surface than the other. As has been stated previously, it is possible to concentrate the heat nearer one surface by using an electrode smaller than its fellow. This makes it, to a certain extent, the active electrode and the greater the disproportion in size the more closely will the heat concentrate beneath the smaller electrode.

When the knee is involved two electrodes of equal size are employed. These can be approximated with the surface contour on either side of the joint or one may be placed above and one below the joint. In this event one electrode should be moulded about the posterior surface of the joint and the other about the anterior. If both are placed along the same skin surface the heat will travel along the most direct path between and the result will be a "surface effect" which will not only fail to get heat into the joint itself but may result in a superficial burn.

Another method is to place cuff-shaped electrodes above and below the joint. The electrodes almost completely encircle the leg or thigh but are placed anteriorly, and do not quite meet posteriorly. The knee should be kept slightly flexed and there should be at least six inches between the points of application.

When the knee joint is being heated through transversely the opposed electrodes should be kept parallel and slightly nearer the anterior than the posterior surface of the joint. This precaution is taken because there is greater tissue resistance anteriorly than posteriorly, and

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for this reason the popliteal space is much more sensitive than the patellar region.

The apposed surfaces of the electrodes are covered with shaving soap and held in intimate contact with the skin surface. They may be held in place by adhesive tape or other strapping or they may be mechanically constructed so as to be self-retaining.

When the electrodes are securely fastened in the desired position the connections are completed and the current is advanced gradually. As a rule, the application need not exceed 1,200 ma., although the tolerance of the patient is the best guide if the maximum heating effect is desired. In the latter instance the current is advanced until the patient complains of a very slight discomfort from the degree of heat; the current is then reduced slightly until there is absolute freedom from all sensation except a pleasant warmth. The current is maintained at the maximum for thirty or forty minutes and then reduced gradually during a period of about two minutes. At no time during the application should the treatment cause pain. The knee should be held slightly flexed and not moved during the treatment. It is, therefore, essential that the patient be absolutely relaxed and comfortable.

CHAPTER SIX

DIATHERMY IN RENAL DISEASE

The authors have had merely a brief preliminary experience with the localizing effects of diathermy on the function of the kidney in health and disease. An extremely wide and interesting field is here open for experimental investigation. Accurate laboratory or clinical data on this subject is lacking.

It is obvious, that if it is possible to "heat up" the substance of the kidney directly, great therapeutic benefits may be derived. By increasing the vascularity of the most vascular excretory organ of the body a local diuretic action would be made possible by purely physiological processes. This would offer us a direct means of stimulating renal elimination in those severe cases of complete renal suppression which sometimes follow general "shock" due to various causes. Most especially would this method be applicable in the cases of so-called calculus anuria.

For a considerable period of time, physiologists and urologists have been seeking a method by which the kidney might be directly "heated up." That diathermy offers the most plausible method of attaining this result is apparent to anyone familiar with both the theoretical and practical consideration of its usage. However, the practical deterrents to successful experimental investigation have not yet been overcome. The authors hope to make an important contribution on this subject at a later date. In the meantime it is desirable to stimulate interest in this important phase of therapeutic control of diathermy.

DIATHERMY

Acute Perinephritis and Pyelitis

In cases of acute inflammation in the renal fossa and body of the kidney diathermy is a valuable medical procedure. It apparently brings about a local congestion which is beneficial and it assists in relieving pain and muscle spasm.

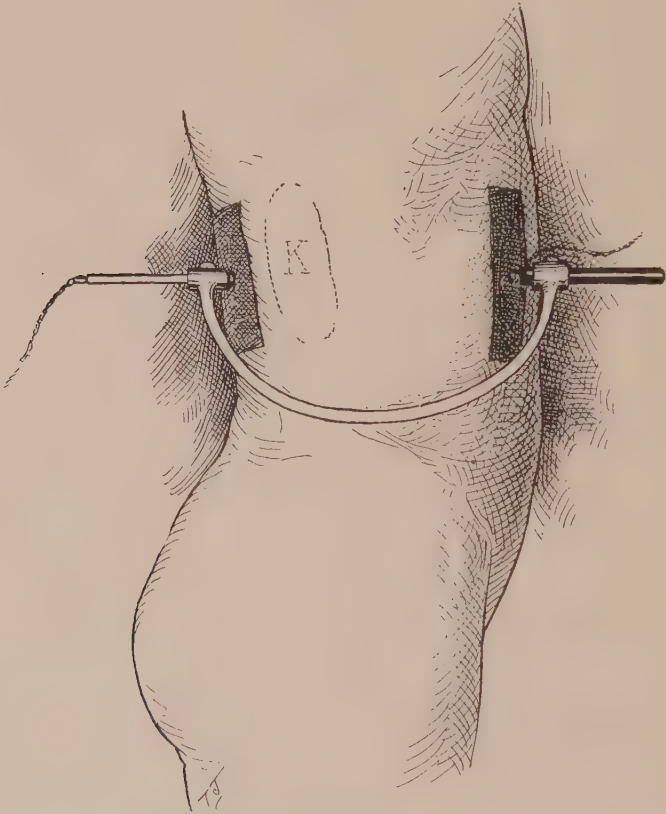


PLATE XVI

Illustrating the relative position of electrodes in the application of medical diathermy to the kidney region. By having the posterior electrode somewhat smaller than the abdominal electrode the heat is more nearly localized in the renal fossa.

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An electrode four inches square is placed over the costo-vertebral region posteriorly and one six inches square over the upper abdomen anteriorly. A current of one thousand to fifteen hundred milliamperes is induced for a period of fifteen to thirty minutes. The heat is supplemented by forced fluids, complete rest, urinary antiseptics and, when indicated, ureteral catheterization and lavage of the renal pelvis. The usual observation for clinical signs of perinephritic abscess must be adhered to, and when present, surgical interference with subsequent drainage is indicated.

Diathermic applications to the renal region should prove helpful as an adjunct measure in both acute and chronic pyelitic or pyelonephritic infections. In conjunction with systemic treatment, elimination of extraneous foci of infection and lavage of the renal pelvis it will materially shorten the obstinate duration of these persistent infections. Its absolute value will be accredited, however, only when we can determine with more accuracy how much heat we are actually inducing into the wall of the pelvis and the body of the kidney itself.

Renal and Ureteral Colic

Several investigators claim great relief by diathermy from the muscle spasm excited by calculi in the renal pelvis and ureter. It has been suggested that this is due to a direct relaxation of the smooth muscle in the ureteral wall constricting the calculus.

The conservative management of the calculi which are small enough to pass through the lumen of the ureter to the point of impaction should include the local application of diathermy while the patient is at rest. These applications should be later supplemented, if necessary, by ureteral catheterization, oil injections through the

catheter and, when indicated, instrumental dilatation of the ureter.

In the interim between attacks diathermy can be given in the hope that its relaxation-producing effects will hasten the passage of the stone without resorting to local instrumental measures.

Diathermy in Bilateral Renal Tuberculosis

Diathermy has been suggested as a palliative measure in bilateral renal tuberculosis. What the direct action of the heat so induced is upon the tuberculous process is unknown. That a curative end result can be brought about is, at the present writing, apparently beyond hope. There is no gainsaying, however, the beneficial effects due to the continued application of diathermy in this unhappy condition.

Several reports³² have been made acclaiming excellent palliative results for symptomatic relief of tenesmus, frequency and dysuria in urinary tuberculosis.

Ureteral Stricture

To Hunner is given the credit of establishing "ureteral stricture" as a distinct clinical entity.

Like urethral stricture, the relief of obstruction in the ureter is best accomplished by slow and progressive dilatation.

Owing to the fact that the ureter is a very delicate structure any instrumentation is followed by more or less irritation with temporary occlusion of the ureter.

It is needless to say, that the above symptoms are variable, depending upon the skill of the operator and the amount of traumatism inflicted at the time of dilatation. However, at times distressing renal colic may occur. Up to the present time few measures have been available for the relief of these distressing sequelae.

DIATHERMY IN RENAL DISEASE

Diathermy is a two-fold agent. First, its effect on scar tissue: In Chapter V, page 61, the treatment of urethral stricture is considered in detail. The authors believe from their experience that the same results can be obtained in the ureter if diathermy is used immediately following a dilatation.

Second, its sedative action: Throughout all our work we have been impressed with the sedative action of diathermy; the action of heat as a sedative we all know is as old as medicine itself. What is more simple than to apply heat by means of diathermy, especially if it can be placed anywhere along the ureter?

Technic

Use a large, flat electrode four by five inches anteriorly and a slightly smaller electrode posteriorly. These are placed over the point of ureteral obstruction. As the ureter is nearer the posterior abdominal wall, our point of heat concentration must be nearer the posterior electrode, and as a consequence it is the smaller of the two.

With both electrodes covered with shaving soap, the current is turned on, and kept just below the point of tolerance for thirty minutes. This can be repeated three or four times a week during the period of dilatation.

Panniculitis

Frequently when prolonged exposures are made there occurs an inflammation of the subcutaneous adipose tissue. This need cause no alarm as it never suppurates.

MEDICAL DIATHERMY IN VESICAL CONDITIONS

Diathermy has a definitely established place in the symptomatic treatment of vesical spasm, contraction, infection and irritation. It must be noted, however, before discussing this subject further, that it is in no way specific, and if used alone will bring only temporary relief.

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In chronic cases where a pyelocystitis has existed for a considerable period of time the mucosa and musculature of the bladder wall may become infiltrated and contracted. The vesical sphincter and muscles of detrusion become irritable and spastic.

The first aim in these individuals is to establish an accurate diagnosis as to the extent and seat of the infectious process. The renal pelves are usually the site of persistent urinary infection with the bladder involvement continuing as a secondary factor. The foci of infection outside the urinary tract must be identified and eliminated before we can hope to permanently destroy the renal or vesical inflammation.

Following the removal of foci of infection, the determination of the exact nature of the infection, and the mechanics of urinary drainage, the question of therapy becomes one of relieving the patient of distressing symptoms.

Forced fluids, urinary antiseptics, such as hexamethylenamin in conjunction with sodium acid phosphate, bladder instillations of various silver solutions and ureteral catheterization, supplemented by washing the kidney pelves, frequently relieve the majority of the cases where surgical interference is not indicated.

In the so-called "irritable bladder," which does not respond quickly to the local and general measures aimed at destroying the infection, a few diathermy treatments have frequently done away with the local symptoms. We have used this method to control the vesical symptoms, especially urgency, incontinence and tenesmus while we were in the process of eliminating the infection by general measures, bladder or renal pelvis lavage.

Where "bladder contraction" has occurred the capacity of the bladder can be increased more rapidly by repeated diathermy treatments than by any other method at our

DIATHERMY IN RENAL DISEASE

command. This is undoubtedly due to the increase in vascularity of the bladder wall and possibly also to the relaxation producing powers on the smooth muscle.

In acute infections of nongonorrheic character, diathermy may aggravate the condition and cause an exacerbation of symptoms.

In the markedly atonic bladder, where incontinence has resulted, the effects of diathermy are less marked. There is a definite benefit to be derived, however, even in this class of cases if treatment is repeated over a sufficient length of time. Apparently the primary relaxation is followed by an improvement of muscle tone possibly due to the augmented blood supply.

In pericystitis and perivesical adhesions diathermy is very helpful. This is especially true where previous pelvic inflammatory disease has caused abnormal peritoneal attachments with adhesion.

The methods which we have used are "intravesical" and "through and through" application of diathermy. In most cases, especially in women, the intravesical and intra-urethral method gives most satisfactory results.

The bladder is emptied by a catheter and flushed with boric acid solution until the latter returns clear. The catheter is then withdrawn leaving a capacity amount of solution in the bladder. The active electrode consists of a metal sound or cylinder, while the inactive electrode is a flat metal plate five inches square or a wire mesh of the same size. The indifferent plate electrode is placed above the symphysis pubis during part of the treatment; during the second part the patient lies upon the plate. Through and through heating with 600-800 ma. for twenty to thirty minutes is sufficient for a single treatment.

In the female we use the urethral electrode with thermometer inserted and maintain a registered temperature of 110° F. (43.5° C.) for twenty minutes.

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Where through and through treatment is given the electrodes are of equal size and they are placed beneath the sacrum and above the symphysis.

There is one other condition to be mentioned in which diathermy may be of great aid. When a tuberculous kidney has been removed and there is persistent bladder contraction and irritability, through and through applications of the heat hasten an increase in capacity and lessen the frequency and tenesmus. In this instance again it is used merely as a valuable adjunct together with hygienic measures, hydrostatic dilatation of the bladder and the judicious use of tuberculin.

CHAPTER SEVEN

SURGICAL DIATHERMY

Brief History of Surgical Diathermy

In 1917, at Dresden, Franz Nagelschmidt, of Berlin, demonstrated with his own instrument the "heating through" of tissues by high frequency currents. He was the first in England to demonstrate the use of diathermy in the treatment of cancer, having done so in Mr. Harmer's Clinic at St. Bartholomew's. Consequently Mr. Harmer may be said to be the pioneer of this method in England.

In 1910 Eugene Doyen³³ presented an account of the treatment of cancer by means of electrically produced heat before the International Congress of Physiotherapy.

In 1919 Norman Patterson³⁴ writing on the treatment of malignant neoplasms of the larynx says: "No excision of a carcinomatous growth in the tongue, mouth or pharynx, however small that growth may be, should be carried out with the knife if diathermy is available."

Turner with Iredell³⁵ advocates diathermy in the treatment of malignancies. Turner demonstrated the method before the Royal Society of Medicine, London, in 1919.

Harrison³⁶ is in accord with Patterson's views in regard to the treatment by diathermy applied in diseases of the pharynx. According to Pfender,³⁷ electrocoagulation is the most valuable adjunct to *x*-rays, in the treatment of skin, lip, tongue, tonsils, pharynx, larynx, cervix uteri and rectum.

During the last few years Gustav Kolischer³⁸ has been an ardent advocate of the use of diathermy followed by radium, and at the meeting of the American Urological

Association in Chicago in 1917, he demonstrated the application of diathermy to a carcinoma of the bladder. The apparatus used at that time was one of special design. He has not only advised the early application of diathermy to neoplasms of the bladder but he has included in his treatment malignant tumors in other parts of the body.

In the surgical application of diathermy no one in this country has had such an extended experience in the treatment of neoplasms as William Clark,³⁹ of Philadelphia.

The recent contribution of John Wyeth⁴⁰ on "Desiccation or Endothermy" is indeed illuminating.

Great credit should be given to J. F. Percy⁴¹ for the persistent way in which he has advocated the use of heat in the treatment of cancer. Year after year, as the lone disciple in the advocacy of heat in the destruction of neoplasms, he has carried his teachings to the medical profession throughout the world. The authors acknowledge that their stimulation to the application of heat in cancer arises from his voluminous contributions to the subject.

As has previously been pointed out, the production of heat by diathermy is indeed most unique, due to the fact that it is produced in the "depths of the tissue" by the resistance of the tissue to the current.

It seems far more rational to presume that the production of heat in the depths of the tissues will result in a more uniform and complete destruction of malignancy than is the case when heat is applied upon the surface in the manner recommended by Percy.

Applied Surgical Diathermy

The "surgical" application of diathermy implies the induction of heat beyond the physiologic tolerance of normal cells.

SURGICAL DIATHERMY

The following methods are available for the surgical application of diathermy.

1. Desiccation or Monopolar Diathermy

This method is called "endothermy" by some clinicians and is produced by the monopolar current, that is, a current high in voltage and low in amperage; as a consequence the relative heat penetration is less than with the bipolar current (a current low in voltage but high in amperage).

Desiccation may be performed with an ordinary sewing needle held in a suitable handle using just enough heat to cause a localized dehydration. In following a technic, the needle should only touch or slightly penetrate the lesion to be destroyed. If the application is followed carefully there is practically no scar. As desiccation is easily performed under local anesthesia, we believe this method especially applicable for the removal of warts, moles, pigmented nevi, chancroidal ulcers and keratoses.

2. Thermic Electrocoagulation with Bipolar Current with a Flat Disk Electrode

By this method the tumor is not escharred but the degree of heat produces a slow coagulation of the tissues, the idea being to infuse heat in the depths of the tumor mass without causing surface carbonization. We prefer the application of this method for all malignant neoplasms. We have found a combination of scopolamin and morphin with ether or nitrous oxid and oxygen the most practical anesthetic. It is advisable to remove the gas apparatus or ether from the operating room during the actual coagulating process.

3. Total Destruction with Thermic-Electrocoagulation

By this means the neoplasm is literally burned up and then escharred. The tissues immediately beneath the

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active electrode are infused with heat so rapidly, and to such a high degree, that the fluids are rapidly extracted and shrinkage and carbonization result without achieving a great depth of heat dissemination.

Scopolamin, morphin and nitrous oxid or ether is also the anesthetic of choice in this procedure.

Fulguration

Sparking and carbonization with the d'Arsonval current under the name of "fulguration" is now an old procedure to most urologists. However, few realize that the carbonization of the tissues by sparking is the one thing that prevents heat penetration. When a given tumor is destroyed by raining sparks down on its exposed surface there is rapidly formed an area of carbonized tissue, the tissue fluids are rapidly removed and there is interposed between the electrode and the underlying neoplastic tissue a layer of carbon which is a non-conductor of electrical currents, which acts as an insulator. In order to pass current into the tissue it must penetrate from the periphery of carbonized tissue, thereby getting farther and farther away from the stalk of the malignant growth.

The problem remains the same whether operating through the cystoscope or following the open method of operation. *If one expects to be successful in effecting heat production in the depths of the tumor he must not at any time carbonize the surface tissue.*

Experimental Data

In order to better understand the technic of thermoelectrocoagulation by the bipolar current with a flat disk as the active electrode, the following experiments on dogs were performed.

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The Degenerative and Regenerative Changes Following Low Degrees of Heat

The degenerative and regenerative changes brought about by the action of diathermy on the bladder wall were studied in a series of five dogs. This study was undertaken for the purpose of determining the extent and character of the reaction, and the type of subsequent scar tissue formation, when the normal bladder wall of the dog had been subjected to electrocoagulation.

Direct "burning back" of the intramural portion of one ureter was accomplished in three animals. The dogs were anesthetized with chloroform and placed upon an operating table. All operative procedures were carried out under strictly aseptic technic.

One thousand milliamperes of diathermic current were used in the electrocoagulation. The bladder was opened in the median line and the trigone and ureteric orifices exposed. The slow coagulation was then applied to the bladder wall, trigone, and the area about the ureteric orifice. The inactive electrode was placed beneath the lower lumbar region.

Results of Experiments:

Experiment 1: A medium sized mongrel bitch was operated upon February 10, 1921. One ampere of diathermic current was applied to the bladder wall over an area one inch square for thirty seconds.

The immediate effect was a slow coagulation, or a "cooking through" of the tissue so that it became ischemic, slightly contracted and slate colored. Desiccation took place without any apparently violent reaction in the tissues and the electrode was removed at the first sign of withdrawal of fluid from the tissue; that is, as soon as "bubbling up" occurred at the edges of the electrode. After removal of the electrode, the edges of the diatherminized tissue were seen to be slightly charred

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in contrast to the markedly necrotizing effect produced by the unipolar current or actual cautery.

Forty-eight hours later, the dog was sacrificed. The bladder wall about the coagulated area was slightly edematous and hyperemic, while the area itself was puckered and bloodless. The edges were black and necrotic and a slough was beginning to form. The area was somewhat indurated throughout the entire thickness of the bladder wall, but there were no adhesions outside of the bladder. Microscopically this area showed complete destruction of the mucosa, submucosa, and more superficial muscle layers. The submucosa and muscularis showed extensive polymorphonuclear and lymphocytic round-celled infiltration and a small amount of extravasated blood. The line of demarcation between the diatherminized tissue and the surrounding normal tissue was very sharply defined. The area of coagulation, however, spread in a cone-shaped manner as the deeper structures were reached.

Experiment 2: On the same day, a similar experiment was conducted and the dog was sacrificed on the eleventh day after diathermy had been applied to the bladder wall. The superficial sloughing mass over the burned area had almost completely separated, leaving a clean "healthy" granulating surface. The reaction and edema in the surrounding structures had disappeared. There were a few filmy adhesions between the posterior bladder wall and the rectum. Otherwise the bladder was mobile and normally contractile.

Microscopically the superficial structures showed a marked round-celled infiltration, no vascularity or extravasated blood, and the upper layers of muscle bundles showed a slow, long-standing degeneration with loss, or disintegration of the nuclei. The more superficial muscle bundles were poorly stained and showed degeneration.

Experiment 3: On November 14, 1920, a full grown collie bitch was operated upon under chloroform anesthesia. A suprapubic cystotomy, followed by the application of diathermy to the right intramural segment of the ureter, was done. The ureter was "burned back" over its entire visible extent. The dog made a complete



PLATE XVIII

Specimen of a right ureteric opening of a bladder of a dog twenty-one days after diathermy burn. The right half of the trigone is replaced by grayish, firm scar tissue. The right ureteric orifice is 1.5 cm. posterior to the normal position and the ostium, which opened in the scar-bearing area, is not contracted or obstructed over this area. The scar occupies the entire thickness of the bladder floor.



PLATE XVII

Specimen of a diathermy burn of the right ureteral opening of a bladder of a dog twelve weeks after operation. The right half of the trigone is composed of an indurated, firm, grayish white scar. The ureteric opening on the right side which had been burned back for a distance of 2 cm. was still functioning normally, although it was surrounded by scar tissue. The ostium is contracted to a pin-point size. The scar tissue occupied the entire thickness of the bladder wall.

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recovery, with healing of the abdominal wound by first intention on the fourteenth day. On April 24, 1921 (21 weeks later), the dog was sacrificed and the entire urinary tract was removed *en masse*.

Autopsy Record: The mid line incision was well and firmly healed by first intention. The bladder appeared slightly contracted. There were no peritoneal adhesions over the anterior or lateral surfaces of the bladder. Posteriorly there were a few filmy adhesions to the rectum but no fixation of the bladder. Both kidneys and ureters were normal in every respect.

The right half of the trigone was replaced by grayish, firm scar tissue. The right ureteric orifice was 1.5 centimeters posterior to the normal position and the ostium, which opened into the scar-bearing area, was not contracted or obstructed. The scar occupied the entire thickness of the bladder floor over this area.

Experiment 4: A full-grown Boston terrier bitch was operated upon January 21, 1921. The operation was similar in every way to that done in the foregoing experiment. Autopsy was performed April 14, 1921 (12 weeks after operation). The kidneys and ureters were normal in every respect. There were several fine adhesions between the fundus of the bladder and the peritoneum and omentum. There were no contractions of the bladder and there were no adhesions posteriorly.

The right half of the trigone was composed of an indurated, firm, grayish-white scar tissue. The ureteral opening on the right side had been burned back for a distance of two centimeters and was still functioning normally, although it was contracted to a pin-point size. The scar tissue occupied the entire thickness of the bladder wall.

Microscopic section of these areas showed: A sharp line of demarcation between the surrounding tissue and the diatherminized area. The latter was entirely replaced by bands of fibrous tissue, arranged both longitudinally and transversely. The formation was very thick and the bundles were closely interwoven with no intervening areolar tissue. The epithelial layers of the bladder mucosa had been replaced by stratified squamous epithelium. There were no muscle bundles present in

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this area except at the extreme edge of the serous surface. The process of regeneration was one of fibrous tissue production with ample vascularity.

Experiment 5: A similar experiment was performed on January 12, 1921, on a black and white fox terrier bitch. After 12 weeks of normal activity, the dog was sacrificed on April 4, 1921. The abdominal incision had healed by primary intention. There were no adhesions about the bladder either to the rectum or the anterior parietal wall. Both ureters were normal; there was no dilatation of the renal pelvis, no atrophy of the renal parenchyma, and no signs of infection in either kidney. The bladder was slightly contracted but mobile. Otherwise, the structure was normal except that the right upper quadrant of the trigone was replaced by a smooth, grayish, fibrous tissue in the center of which the ureteral opening protruded. The orifice was 1.5 centimeters posterior to its mate. Both were normally patent.

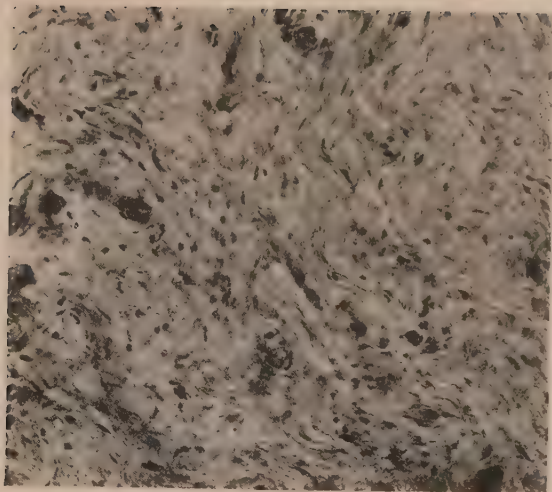
Summary

Electrocoagulation of the normal bladder wall of the dog by diathermy is followed by distinct, uniform tissue reaction.

The immediate effect is a slow "cooking through" of the underlying tissues, the effect upon the deeper structures being the same as that upon the mucosa. This is followed by an aseptic death of the submucosa and muscularis. Round-celled infiltration is marked only for the first three days. Eventually the entire area is replaced by a dense proliferation of fibrous tissue, the line of demarcation between the treated area and the surrounding normal tissue being definitely preserved.

Advantages of Diathermy Over Cutting Procedures

In the operative treatment of neoplasms, it is necessary in working out a technic to keep constantly in mind that every step of the operation must be so planned as to avoid implanting tumor cells on raw or cut surfaces.



PLATES XIX AND XX

Microscopic sections of scar tissue taken from dog's bladder twelve weeks after diathermy burn.

The areas show a sharp line of demarcation between the surrounding tissue and the diatherminized area. The latter is entirely replaced by bands of fibrous tissue arranged both longitudinally and transversely.

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Diathermy is absolutely bloodless if a flat or blunt electrode is employed which, if properly used, insures not only total destruction of the mass but also sufficient coagulation of the tissues in the immediate neighborhood to minimize the possibility of cell implantation.

Vascular structures situated in the near vicinity are sealed, thereby lessening the absorption of infection. Consequently a shorter convalescence is insured.

On account of the absence of any extensive cutting procedure postoperative shock is minimized, and this is of great value in operating upon patients of advanced years.

Lastly, and most important of all, is the density and extent of the scar tissue that results after the employment of diathermy in treating malignant disease. The body defense against carcinoma metastasis lies in the formation of a connective tissue capsule. The scar tissue that is formed after a diathermy "burn" is more dense and spreads farther into the surrounding tissue than is the case after any cutting operation; therefore, we have an extensive reenforcement of Nature's attempt to throttle the embryonal cell.

CHAPTER EIGHT

SURGICAL DIATHERMY IN BENIGN GENITO-URINARY CONDITIONS

Warts

Coagulation or desiccation is the method of choice for destroying accessible wart-like or polypoid growths, whether cutaneous or membranous in origin.

The trauma and mutilation incident to surgical excision are avoided and the method is bloodless. The slow sloughing of the desiccated area permits the formation of an inappreciable scar. The possibility of cellular transplants in the surrounding tissue is eliminated.

Cutaneous or "Flat" Warts

Warts occurring about the scrotum, prepuce or labial regions may be readily removed by either fulguration or desiccation. Since the latter method is far more preferable, we will discuss it only.

Local infiltration anesthesia circumscribing the growth, but not closer than one-half centimeter of the border, is sufficient. A fine needle is introduced at the base of the growth and short applications of monopolar current of very low strength are controlled by a foot switch. The area surrounding the base gradually becomes grey and slightly shriveled, indicating that sufficient desiccation has taken place. The wart above this area is dry and in a few hours crumbles off, leaving a dry surface scab. Healing takes place beneath this and is usually completed in ten days or two weeks.

BENIGN GENITO-URINARY CONDITIONS

Verruca Accuminata ("Venereal Warts")

Papillomatous overgrowths of the prepuce, corona glandis, scrotum, anus and vulval regions are most common. Contrary to their common terminology they are not necessarily venereal in origin. They are caused by inflammation, lack of cleanliness or other persistent irritations such as urethral or vaginal discharges. They are usually papillary, highly vascular and composed of epithelium which is readily transplantable to form other neighboring excrescences.

The most satisfactory method of destruction is effected by the needle method of desiccation previously described. Balanitis, phimosis and urethral or vaginal discharges must be eliminated to prevent recurrence. When healing has taken place the scar is superficial and soft and circumcision can be done without danger of implantation.

Caruncle of Female Urethra

The term "caruncle" as applied to the female urethra includes the various types of mucous polypi which take origin at the meatus. These may arise from a broad base or a slender stalk and are usually found on the floor of the vestibule. The caruncle is intensely red in color owing to its extreme vascularity. It is often exceedingly tender.

Caruncle may be very distressing or it may cause no symptoms at all. Urethral pain during urination, pain during coitus and hemorrhage from surface erosions are the troublesome symptoms.

The type of caruncle which arises as an acute reaction to persistent gonorrheal inflammation of the endocervix and urethra usually subsides with the irritative discharge. Occasionally the condition persists even in the absence of all irritation.

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Caruncle occurs more frequently in women past middle age and in these instances is rarely preceded by venereal disease.

Microscopically the caruncle is covered with a squamous-celled epithelium and the underlying connective tissue shows round-celled infiltration. The epithelium sends off-shoots into the deeper tissues and these on cross section, have frequently been mistaken for squamous-celled carcinoma. In this instance microscopic evidence and clinical fact are not closely related.

In the past chemical cauterization or surgical removal has been the method employed to eliminate caruncle. Both are unsatisfactory. Operative mutilation and hemorrhage are undesirable, and there is a large percentage of recurrences.

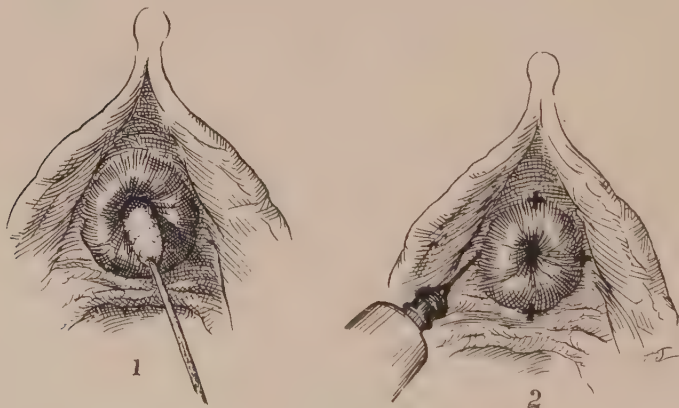


PLATE XXI

Illustrating the method of anesthetizing the region of the female urethra. 1, Shows the application of 4. per cent cocaine solution to the urethral mucosa. 2, Shows the points of infiltration for securing complete anesthesia in the treatment of urethral prolapse, caruncle and polypi.

The following describes our preparation for destruction of caruncle, polypi or prolapse of the female urethra: The patient is placed in the lithotomy position

BENIGN GENITO-URINARY CONDITIONS

with the knee rests widely separated. The vulval folds may be retracted on either side by wide rubber bands which are fastened behind the upper thigh and over the iliac crest in the fashion of a male suspensory. This obviates the necessity of an assistant. The labial and urethral regions are cleansed and sterilized. A cotton swab saturated in 4 per cent. cocain solution is introduced into the anterior urethra and retained for five minutes. During this latter period a small amount of one-half per cent novocain solution is injected into the para-urethral tissues as shown in the accompanying illustration. When the urethral swab is removed, perfect anesthesia is accomplished for the desiccation of the caruncle, despite its size. If the growth is large the urethral mucosa should be drawn downward with forceps.

The needle electrode is introduced into the base of the caruncle, always being held transversely with the floor of the urethra. A low degree of current is applied and controlled by a foot switch. Carbonization and sparking are to be avoided. A mere desiccation process which destroys the blood supply is most satisfactory and any degree of scar is avoided. There is slight sloughing after eight or ten days and healing is rapidly completed without subsequent recurrence, urethral stricture or distortion.

Another method of destroying warts, verruca acuminata and caruncle by desiccation is as follows: With a very weak monopolar current, using a very fine needle electrode, the tissues immediately surrounding the excrescence are dehydrated. The point of the electrode is then passed over and then into the growth until the entire area has been thoroughly desiccated.

Occasionally it may be necessary to gently curet the superficially desiccated areas in order to reapply the

electrode so that the deeper layers may be subjected to further dehydration.

Prolapse of the Female Urethra

Prolapse of the urethral mucosa usually occurs in women past middle age. It is often associated with relaxation of the surrounding tissues, cystocele, procidentia and caruncle. We have observed this condition in three patients of middle age when urethro-cystoscopy was negative and in whom no other relaxation was present.

We had used "fulguration" in this condition since 1918, although this method was first described by Livermore⁴² in 1921.

Slow bipolar electrocoagulation is accomplished by placing a thin, flat electrode one-half inch long and one-eighth of an inch wide directly in contact with the mucosa. A slow desiccation is preferred as the entire depth of the mucosa should be coagulated. When steaming occurs at the edge of the electrode the current is released. The electrode is then applied to three equidistant portions of the lumen in the same manner. At the time no appreciable shrinking of the prolapse is evident. The bulging meatus shows four greyish-white lines of desiccation with normal mucosa between.

Sloughing of these areas takes place slowly or not at all. A slow scar tissue formation results which contracts the mucosa symmetrically, literally pulling the meatus and surrounding mucosa inward. If the coagulation has been done transversely with the urethral wall, no actual contraction of the lumen results. We have treated ten cases in this manner with perfect functional end results.



PLATE XXII

1. Method of destroying caruncle of the urethra.
2. Appearance of urethral prolapse immediately after treatment.
- A. Appearance of urethra six weeks after the above treatment.

BENIGN GENITO-URINARY CONDITIONS

Polypi of Female Urethra and Vesical Orifice

Polypi occurring in the posterior portion of the female urethra are quite common. They are usually associated with, or the aftermath of, a chronic urinary tract infection and are found on cystoscopic examination in many of these cases.

The polypi vary in number, although frequently they project into the bladder from the posterior urethra and form a complete rosette at the vesical orifice. They are not true papillomata and are easily distinguished from them.

These growths are best seen through a water dilating, direct vision urethroscope. As a rule, they are greyish-pink in color, villous, slightly translucent, and have a prominent *peripheral* blood vessel. Frequently the presence of these polypi may be ignored, especially if they are small or few in number. At other times their size interferes somewhat with urination and may cause marked dysuria.

These may be easily and permanently destroyed with monopolar desiccation by a small pointed electrode insulated to the tip. The electrode is pushed into the folds at the base of the polyp and a low degree of current applied.

The usual bubbling or sparking effect of "fulguration" should be avoided if possible. There is a gradual whitening of the polyp accompanied by shrinkage in size. The procedure is repeated until all of the villi are whitened. If the low degree of current is used and the electrode always buried in the folds at the base of the polyp, practically no pain or subsequent scar formation will result.

D I A T H E R M Y

It should be emphasized that these growths indicate chronic urinary infection which may demand other appropriate treatment.

Chancroid

In offering diathermy as a logical procedure in the treatment of chancroid, it must be borne in mind that this form of therapy is not a panacea for all kinds of genital ulcers. Suffice it to say, however, that it is common to find chancroid and chancre in the same individual either in the same ulcer or in different ulcers. Every genital ulcer should be examined carefully for the spirocheta pallida and search continued diligently until the presence of the organism is excluded before any mutilation or treatment is practiced in the way of burning or cauterization. There is no longer any excuse for haphazard diagnosis in genital ulcers. It is true, that clinical appearance, multiplicity, lack of induration, etc., may be clear and characteristic, but no one should permit an ulcer to come under his care without a thorough microscopic examination.

There is no single condition that receives such careless attention as do simple ulcers that occur on the genitalia, and as a result inguinal adenitis or inguinal bubo is a common sequel. Frequently it is in itself more painful and destructive than the original infection. However, if the primary infection (chancroid) is properly treated at its inception, suppurative inguinal adenitis should not occur.

Robbins and Leabury⁴³ first called attention to the following method which we have modified slightly:

A 25 per cent solution of copper sulphate in distilled water is applied to the sore for a few minutes, then a needle electrode connected to a single pole of the diathermy apparatus is carried down to the border of the ulcer

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and continued around the whole circumference of the lesion until the entire border is completely desiccated. Finally the center of the lesion is treated in the same way, care being taken to carry the desiccation well outside of the undermined chancroidal ulcer. We believe that the desiccation is superior to sparking, as it does not carbonize the tissues and at the same time it permits greater heat penetration. A light antiseptic dressing is placed over the lesion and in a few days we have changed a chronic sloughy ulcer into a healthy granulation tissue.

In case there is a slight recurrence the procedure may be repeated.

Inguinal Adenitis and Inguinal Bubo

On palpation the individual inguinal glands that run parallel to Poupart's ligament are easily identified. The glands are hard and very tender, while the skin over the mass is slightly congested and freely movable. At this period the glands may either undergo resolution and recede or the condition may become progressively worse.

Prompt and early desiccation of all chancroidal ulcers should be performed.

Never cauterize chancroids with silver nitrate or phenol alone, as they both tend to seal over the top of the ulcer and cause absorption of the underlying strata with resulting inguinal adenitis.

Using the bipolar current, place an electrode four by six inches under the buttock that corresponds to the side of the infected glands. Next place an electrode from one and one-half to two inches by four inches long over the infected glands. Soap each pad well with shaving soap to insure its close approximation to the skin. Gradually increase the current to the point of tolerance. Beneath the smaller of the two electrodes there will be an area of the greatest heat production. If this is

continued for thirty to forty minutes daily either resolution takes place or softening occurs. In the latter event the glands must be incised and drained.

The relief of pain and discomfort following a single treatment with diathermy is remarkable.

Vesicovaginal Fistula

Fistulae between the bladder and vagina are often the result of difficult parturition or operative procedure. When the fistulous opening is small and there is little or no urinary infection, some of these may be closed by coagulation of the sinus tract.

Large fistulae, or those resulting from the use of the actual cautery or radium, are not favorable for this attempt.

The fistulae should be thoroughly but slowly coagulated so that all epithelial connection is destroyed and a certain amount of surrounding tissue reaction produced.

The cystoscopic electrode is placed in the vesical opening of the sinus where the amount of destruction can be observed. It is then carried more deeply and the canal through the vesicovaginal septum is coagulated. An extensive slough should be avoided. In some instances it is well to introduce a vaginal speculum and destroy the lower portion of the tract although this may be coagulated from above. A retention catheter is placed in the bladder after two or three days and, if possible, the patient may be placed in such a position that the lowest bladder surface is away from the opening.

Suction bottles may be used to assist gravity in keeping the bladder as dry as possible.

In the event of failure of this method the patient has lost nothing but the time entailed in the three week period of rest in bed. Later an open operation may be performed.

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When the fistulae are small this procedure is well worth trying. We have had a complete closure in three out of six selected cases.

Ureterocele (Ureterovesical Cyst)

Dilatation of the terminal portion of the ureter, with protrusion or herniation into the cavity of the bladder, is due to a narrowing, generally congenital, of the ureteral orifice. The continued pressure of the urine on the lower section of the tube results in an intravesical bulging below and varying degrees of ureteral or pelvic dilatation above. The obstruction may or may not be complicated by urinary infection.

On cystoscopic examination the ureteral orifice may be found to be so minute that the finest ureteric catheter or bougie cannot be introduced. Frequently the orifice is hidden in the redundant mucosal pouch and cannot be found even after prolonged visual examination.

Destruction of the thin, protruding ureterovesical wall will eliminate the obstruction and allow free ureteral drainage. In instances of acute pyelonephritis of the partially obstructed kidney, with resultant complete occlusion by inflammatory swelling of the otherwise narrow ureteral opening, the condition may demand emergency measures.

The superiority of heat destruction in comparison with cutting operations has been demonstrated in our experience with five cases.

In the first two cases suprapubic cystotomy and excision of the cyst-like protrusion was accomplished with excellent end results.

In the last three cases the entire area was destroyed by bipolar electrocoagulation through the cystoscope with equally good results.

In the presence of severe infection, especially when acute in character, it is well to be content at the original cystoscopy with establishing an area of free drainage. The most accessible portion of protruding mucosa is burned through, using a small cystoscopic electrode (McCarthy or Bugbee) so that the opening may be enlarged both horizontally and vertically. This leaves a crossed linear opening which is less liable to immediate closure than a single round perforation.

The ureter may then be catheterized and free drainage established. In the acute cases the catheter may be left in the ureter if indicated.

At a later date the remainder of the cyst wall should be destroyed. When the border is definitely outlined the electrode may be moved along the surface destroying its attachment to the bladder mucosa so that it sloughs off *en masse* in a few days. If the limits are not sharply demarcated the mucosa may be destroyed by successive coagulations beginning at the center and approaching the periphery.

There is little or no tendency for ureteral obstruction to reform as there is no resultant scar tissue about the ureter itself.

Stone or infection complicating these cases call for separate consideration. If the stone lies in the dilated pouch it may be passed into the bladder after the cyst wall has been destroyed. The advantages of this method as compared with suprapubic cystostomy and excision are obvious.

Calculi Impacted in the Lower End of the Ureter

When a calculus is impacted in the intravesical portion of the ureter and the orifice is too narrow to allow its passage into the bladder a linear burn may be made through the mucous membrane by the cystoscopic ap-

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plication of the unipolar current. The mucous membrane sloughs off in a day or two and the enlarged orifice allows the stone to drop into the bladder.

The value of this method was first described by Furniss⁴⁴ and later emphasized by Young.

CHAPTER NINE

HEAT IN CANCER

During the last ten years the treatment of tumors of the urogenital tract and particularly tumors of the bladder has received serious consideration by the urologists. This study has been stimulated by the fact that, despite our advances in surgical technic, the results following excision of tumors of the bladder have been far from brilliant. As recently as May, 1920, Lower⁴⁵ said: "Undoubtedly the most difficult outstanding problem in genito-urinary surgery is the treatment of malignant tumors of the urinary bladder." Aside from the disposition of the benign papillomata by fulguration, the results have been most discouraging. This is true of carcinoma, whether scirrhus or papillary, and is especially true of these malignant tumors that involve the ureteral ostium.

During the last three years there have appeared in American literature monographs by our foremost urologists, and all seem to agree that wide and clean excision offers the best method in the treatment of malignant growths. When such excision is impossible, the actual cautery has been applied in many instances with some degree of success.

According to Doyon,³³ "one brutal fact dominates the surgery of cancer; the frequency of its recurrence or of its reinoculation in the wound. In the case of surgery, the operation acts as a veritable stroke of the whip to the cancerous infection by sowing the virus all over the surface of the field of operation. The pathological cells, which are able to resist the action of the phagocytes are disseminated like pollen by a gust of wind and thus become the germinal foci of as many cancerous nodules."

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Of all the physical means employed in the destruction of pathological tissue the only certain method is heat. In the attack on the cancer cell with heat, we must bear in mind that pathological cells offer less resistance to all destructive agents than do normal cells. This lowered vitality of the cancer cells dominates the whole question of the local treatment of cancer by heat.

Rohdenberg⁴⁶ says: "It appears that the most efficacious of all the many conditions which can bring about regressive changes in cancer is heat, applied from without or occurring under the limited conditions of long duration and comparative low degrees."

Quoting from Percy⁴⁷ we have the following: "Heat is known as a great force in physical nature; and it is harnessed and made to perform many services to mankind. Like all the great compelling powers of creation it is invisible, except through its effects and it defies analysis. It has no weight, no dimensions, no substance. It is synonymous with sunlight and can be produced by fire, electricity, friction or chemical action. Its destructive possibilities are legion and not the least of these, is its power for good when regulated and applied to abnormal human tissues. It will probably never be better known to man than as one of the great correlated forces. Can any of us fathom what would have been saved the members of the human family, when suffering from cancer, had it been the rule to apply a piece of hot iron to every abnormal growth while it was still a small affair? The chance that heat may, in the near future, be the solution of the question of the successful treatment of all forms of cancer is not sufficiently appreciated by surgeons. The fundamental thing in the use of heat which has not been entirely understood by those of us who wish to make use of it in a successful way, is that the results depend on the dissemination of heat until the

tissues known to be involved in the malignancy and those only suspected to be involved are fully infused. The essential, the necessary, the important element, is a degree of heat that laboratory and clinical experience has shown will kill the cancer cell in the tissues regardless of whether it takes a long or short time to get it there."

Great credit should be given to Dr. J. F. Percy for the persistent way in which he has advocated the use of heat in the treatment of cancer. While we are not in favor of his method, we are heartily in sympathy with his idea.

Jensen⁴⁸ has placed the vulnerability of cancer cells at 48° C. (116.6° F.) for five minutes; Loeb⁴⁸ for sarcoma at 45° C. (113° F.) for thirty minutes.

Lambert⁴⁹ has recently pointed out that temperatures above 42° C. (107.6° F.) were distinctly harmful, and that the degree of injury to both normal and cancer tissues depends on the degree of temperature and length of exposure. He further states that sarcoma cells are destroyed by exposure at 42.5° C. (108.5° F.) for from twenty-four to forty-eight hours; 43° C. (109.4° F.) for six hours; 44° C. (111.2° F.) for fifty minutes; and 46° C. (114.8° F.) for twenty minutes; while normal connective tissue cells survive these various exposures.

E. Vidal⁵⁰ noted the arrested evolution of tumors in four patients with a temperature above 40° C. (104° F.). In order to be sure that this was not a quadruple coincidence, he daily exposed tumor-bearing mice to temperatures above normal, and found that they lived longer and that the tumors were the seat of degenerative changes. In a bitch having a spontaneous lymphosarcoma, the zone of Richet was punctured, the temperature rose to 40.8° C. (105.3° F.) and the tumor diminished in size rapidly and finally entirely disappeared. In this connection, Vidal⁵⁰ makes the startling and original

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observation that the method of treating carcinoma by vaccines and toxins, etc., is attended by a reaction, the principal symptom of which is an increase in temperature, and when such reaction is absent, the several authors state that there is no salutary influence on the carcinoma. He concludes that these various methods owe their success largely to their fever-producing qualities.

It has been shown conclusively by numerous laboratory workers that the malignant cell cannot be successfully transplanted after an exposure of ten minutes to a temperature of 113° F. (45° C.). It likewise has been shown that the normal tissue cells will bear a temperature of 132° F. to 140° F. (35° C. to 60° C.) without being destroyed.

Geraghty⁵¹ says: "It is of interest to note that the use of radium alone has not diminished the tendency of bladder tumors to recur, recurrences being observed in about 30 per cent of cases treated."

A careful review of the literature points to the fact that the treatment of tumors of the urogenital tract by excision is most discouraging. As the treatment of malignant tumors by excision is at best precarious and uncertain, would it not be better to utilize a method that not only destroys the tumor but that at the same time minimizes the possibility of metastases?

CHAPTER TEN

CARCINOMA OF THE PENIS

According to Hazen,⁵² the researches of Krompecher⁵³ and Bloodgood⁵⁴ have definitely established the fact, both clinically and pathologically, that tumors arising from the superficial epithelium are of two varieties, prickle cell and basal cell.

The prickle cell carcinomas are most common on the mucous membranes, especially on the lip. They form the vast majority of all cancers of the extremities and may occur anywhere on the cutaneous surface.

The relative frequency of carcinoma of the penis, compared with its appearance on other parts of the body, has been estimated as being from 2 to 3 per cent.

Location

Prickle cell cancers arise most frequently from either arsenical or röntgen ray keratoses and, according to Hazen, less frequently from scars due to burns or wounds that have healed by granulation, from leg ulcers, from wens and from various chronic dermatoses. This is especially true in cancer of the penis, where the tumor begins on the glans or inner leaf of the foreskin as a result of a chronic balanoposthitis with resulting retained smegma and decomposing urine.

Nothing can be added to the description of these tumors, as they have been well described and studied by numerous observers, prominent amongst whom are Barney⁵⁵ and Cunningham⁵⁶.

Pathology

Prickle cell carcinomas, as a rule, metastasize to the regional lymphatics, although this may not take place for

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years; from here, metastases extend to the lumbar glands along the vertebrae and here the condition may be dormant for a long time, later springing into activity.

Gross Pathology

When a prickly cell cancer is excised and cut through, three things are to be noticed: First, that the surface is rough; second, that the infiltration is deep; third, that the cancerous alveoli radiate downward in the form of white lines, about the size of a very fine thread.

Microscopic Pathology

When a section from a prickly cell carcinoma is stained with hematoxylin and eosin or with the similar combination of acid and basic dyes, it is noted that the cancerous alveoli are large, and that there is a great tendency for whorl formation to occur. These whorls are very apt to result in epithelial pearls. In addition, the individual cells are large and stain intensely with the acid dyes.

Diagnosis

The solution of the cancer problem lies in the early recognition of the disease and its adequate treatment. This can be best accomplished by educating the laity to seek early advice and the medical profession to recognize it in the early stage and to avoid any attempt at complete or incomplete circumcision.

With an early diagnosis and with immediate and proper treatment, the prognosis is excellent. *In late diagnosis, even with skillful treatment, the prognosis is fatal.*

According to the best authorities, under no circumstances should a section of a growth be removed for diagnosis by simple excision; for such a procedure leaves the blood vessels and lymphatics gaping and favors the dissemination of the cancerous process, inasmuch as malignant cells can readily enter the circulation.

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Of late years, the procedure of diagnosing genital ulcers has been so well established by the process of elimination, that it should not be difficult to recognize a cancerous condition without excising a piece of tissue for diagnosis. If a section of tissue is deemed necessary, this should be taken by the actual cautery just immediately preceding the thermo-electrocoagulation.

Treatment

The treatment of cancer depends upon the diagnosis. The earlier a diagnosis is made and treatment instituted, just so much more promising is the prognosis. Complete emasculation of an individual with the grave possibility of resultant metastases is so discouraging that the growing tendency in the treatment of epithelioma of the penis by the knife is to avoid any procedure that causes unnecessary mutilation and increases the liability to regional metastases.

Thermo-Electrocoagulation

Preparation of Patient

Shave and prepare the parts including the inguinal region in like manner as for any surgical procedure. If the patient is to be operated upon at 9 A. M., no fluids are permitted after 2 A. M. A high soap suds enema is given at 6 A. M., $\frac{1}{4}$ or $\frac{1}{6}$ gr. morphin sulphate and $\frac{1}{100}$ or $\frac{1}{150}$ gr. scopolamin, depending upon the amount of narcosis desired, are given hypodermatically at 6:30 A. M., $\frac{1}{6}$ gr. morphin sulphate and $\frac{1}{150}$ gr. scopolamin are given at 7:30 A. M. and the same amount is repeated at 8:30 A. M. Operate at 9 A. M. Care in keeping the patient quiet and in a darkened room, avoiding conversation and any undue commotion, should be carried out as a routine. We have frequently found that "twilight sleep" alone is sufficient for the entire procedure.



PLATE XXIII

Illustrating the method of applying surgical diathermy to carcinoma of the penis and inguinal glands. *A*, Shows active electrode in contact with the glandular metastases. *B*, Shows the active electrode applied to carcinoma of the glans penis.

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Technic

Using the bipolar current with the inactive electrode beneath the sacral region and interposing between the skin and the electrode a gauze pad moistened with hypertonic salt solution (10 to 15 per cent.) and employing a flat disk active electrode from 2.5 to 3.0 c.m. in diameter, the operator is ready to proceed with the coagulation.

Owing to the fact that thermo-electrocoagulation is a slow process and that comparatively low degrees of heat are used, it is unnecessary to insulate the table, patient or operator as was previously described in the earlier reports on this procedure. If the operation is continued for some time, care should be taken to keep the gauze pad moistened. Apply the active electrode firmly to the parts and slowly turn on the current, beginning with about 500 milliamperes. Be careful to avoid all sparking and carbonization. Heat the cancerous tissue until it becomes white and blanched but avoid any steaming or severe cooking of tissue. The utmost care should be taken to proceed slowly and to coagulate not only all the cancerous tissue but sufficient apparently healthy tissue to insure total destruction of the growth. Frequently the cancerous tissue surrounds the urethra and any severe or unnecessary burning will injure the urethral canal and later cause troublesome stricture formation.

Inguinal Adenopathy

Unless seen extremely early inguinal adenitis is invariably present following epithelioma of the penis and unless destruction of the extended process is carried out here our efforts will result in failure, no matter how thorough the destruction of the primary focus has been.

With our present knowledge, two methods are available for destroying the malignancy here.

First, deep x-ray therapy.

Second, diathermy.

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If diathermy is employed the skin over both inguinal regions, under strict surgical technic is dissected free from the superficial fascia, care being taken to avoid the slightest injury to superficial glands. With the active electrode consisting of a flat disk 1.5 to 2 cm. in diameter, the glands are slowly heated until the parts are so well infused with heat that they are intolerant to the gloved finger. Do not coagulate the tissue here at all as there is danger of injury to the femoral vessels if the coagulation is carried out too energetically. A few strands of silkworm gut are placed in the wound for drainage and closure is made in the usual way.

Application of Dressings

As the coagulation seals the lymphatics and closes the minute capillaries there is no danger of sepsis or hemorrhage following electrocoagulation but it is well to cover the coagulated area with a dry sterile dressing, and for cleanliness this should be changed daily. The coagulated epitheliomatous tissue on the penis forms a slough that usually separates after the eleventh to the fourteenth day. Over the heated inguinal glands there may be some excessive exudation of serum which may necessitate daily dressing. As a rule, the silkworm gut may be removed on the third day and the stitches on the ninth to the eleventh day.

Postoperative Care

Owing to the fact that there is little shock, patients who have been operated for epithelioma of the penis by thermo-electrocoagulation convalesce rapidly. As there is a slow protein absorption from the coagulated tissue it is well to encourage the ingestion of fluids to dilute these substances. There are no dietary restrictions.

CHAPTER ELEVEN

CANCER OF THE FEMALE URETHRA

Primary carcinoma of the female urethra most frequently develops in the mucosa of the urethra, and is usually of a squamous cell type, of higher malignancy than is the rule for structurally similar tumors on cutaneous surfaces. It is more properly speaking, an epithelioma.

Urethral adenocarcinoma in the female originates in the periurethral glands and is analogous to prostatic carcinoma in the male, occurring most frequently in younger women.

Epithelioma of the female urethra may be of two different types. First, an irregular, elongated ulceration involving only the mucous membrane of the floor, usually occurring in the distal segment, and second, a periurethral indurated tumor with a tendency to involve surrounding tissue extensively and occlude the urethral canal.

The lymphatic extension in the growths which are primarily in the urethra, is upward along the inside of the pubic ramus and into the inguinal nodes. Both superficial and deep lymphatic chains become involved in the extension. In the majority of instances, where the growth is detected early, either there is no extension at all or only the superficial inguinal glands are involved. In the more advanced cases the superficial subinguinal, the deep femoral and the intrapelvic nodes are involved.

Some of the predisposing factors mentioned are low grade chronic urethritis, urethral caruncle, malignant

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degeneration of a urethral polypus, local inflammatory processes and various forms of leukoplakia from protracted urethritis. Analyzing the case reports from a statistical point of view, it is not apparent that there was a pre-existing inflammatory condition of the urethra in many instances.

Every irregularity in mucosal texture about the urethral orifice should be closely scrutinized. In case of doubt as to the exact nature of the growth, malignant degeneration must be borne in mind.

There are no characteristic symptoms of urethral carcinoma except the appearance of the growth itself. It must be differentiated from chronic hyperplastic urethritis, caruncle, polypus and prolapse of the urethral mucosa.

Primry carcinoma of the female urethra should not be confused with carcinoma of the vulva and vaginal wall. This latter condition is most often papillomatous with a ragged fungating margin and tends to spread laterally, involving the cutaneous surfaces of the vulva and vagina rather than the deeper periurethral structures.

The treatment of these urethral growths until recently has been extensive surgical removal of the urethra and cancer-bearing areas. The difficulty of surgical excision in well advanced cases is evident. Of the many cases operated upon and reported in the literature only a few very early cases have accomplished successful excision with maintenance of urinary control. In the main, however, surgical excision has led to structural mutilation and functional derangement. The end results have hardly justified the procedure. Radical inguinal dissection to eradicate regional extension is practically always a failure because of the presence of intrapelvic and intra-abdominal metastases.



PLATE XXIV

External appearance of carcinoma primarily involving the urethra.

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In some instances radium has a marked effect upon these tumors but only in the earliest stages. Diathermy assumes the procedure of choice for destroying primary urethral carcinoma, periurethral carcinoma and epithelioma or papilloma of the vulval or labial regions. All specimens for microscopic diagnosis should be carefully removed with the actual cautery. The technic of coagulation discussed in previous chapters is used in the local destruction. Special care is taken to avoid coagulating the entire length of urethra into the bladder neck. A gloved finger should be placed in the vagina and pressure made upward and forward while the tumor mass is being coagulated. The destruction is performed slowly with short intervals between current applications. Carbonization is avoided.

Regional gland involvement is handled as described under the treatment of cancer of the penis.

Diathermy offers a method which is superior to any previously described in effecting the local destruction of carcinoma of, or about, the urethra. Complete urinary function can be retained because the urethra can be coagulated as far as the triangular ligament (0.5 cm. from vesical orifice) without destroying sphincteric action. Even in hopelessly advanced cases all local symptoms are relieved by the procedure. A general anesthetic is unnecessary, there is no operative shock, postoperative discomfort is slight, and even in advanced cases, urinary control can be maintained.

Two illustrative cases are quoted:

Case I: Flora H., white, American, housewife, aged 54 years, was presented in consultation by her doctor on April 6, 1922, at the Washington Boulevard Hospital. Her chief complaint was a bloody discharge from the region of the urethra, more marked following the act of urination. This condition had existed for five months

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with a gradually increasing amount of bloody discharge especially noted upon her underclothing or perineal napkin. The bleeding was intermittent for the first three months but more recently had been continuous. Burning on urination had gradually increased until it was a very distressing symptom. No undue frequency of urination had occurred. Her general health had remained excellent and there was no other complaint.

Previous local examination had been denied and a plain röntgenogram of the pelvis had been made. This showed a dimly outlined, apparently calcareous mass in the region of the bladder neck. Numerous areas of increased density within the outline of this mass had suggested the possibility of a large vesical calculus.

Past history was unimportant. There had been three normal pregnancies with healthy children. No family history of cancer or tuberculosis. Other than early diseases of childhood the patient had always enjoyed good health. Normal climacteric occurred ten years previously. No history suggestive of possible urinary infection associated with or following pregnancies was obtained. There was no history of venereal disease or vaginal discharge. No recent loss in weight. Physical examination showed a well nourished woman without sign of emaciation.

The head, eyes, ears, nose and throat, chest, heart and abdomen were normal. Blood pressure 120-80.

There was no costo-vertebral or suprapubic tenderness.

Palpation of both inguinal regions showed a chain of hard confluent enlarged lymph nodes, the largest being about 1.5 cm. in diameter. These were not adherent to the surrounding structures or to the skin.

In the femoral region on the left side there was also a hard lymph node enlarged to the diameter of about 2 cm.

Local examination: Completely surrounding the urethra there was a rounded reddish-pink tumor, so large that it pushed forward both labia. The growth practically obscured the urethral orifice. The mass measured 5.5 cm. in diameter with an elevation from the base of the urethra of 2.5 cm. The outline on the



PLATE XXV

Thermo-electrocoagulation of carcinomatous area. Active disc shaped electrode shown with tumor mass partially coagulated. Inactive electrode is beneath the sacral region.

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left was smoothly demarcated, but on the right and above, the structures of the labia minora and base of the clitoris were involved in the growth. In these areas the margin was ragged and presented an elevated indurated border. There was no extension to the vaginal surface. On vaginal examination the mass seemed to encircle the urethra throughout its entire length. There was no extension felt posteriorly or in the lateral vaginal fornices.

Cystoscopic examination showed a normal bladder with the exception of a slight trigonal injection. Examination of the urine obtained by catheter proved normal except for an occasional pus cell.

The blood Wassermann was negative, erythrocytes 4,500,000, leukocytes 8,500, hemoglobin 80 per cent.

On April 8, 1922, after removing a portion for section, the entire growth was coagulated by diathermy. A flat, active electrode was used with the inactive electrode over the suprapubic region. With a thermometer in the urethra, the local temperature was raised during the coagulation to 115° F. A finger held beneath the vaginal portion of the tumor mass also served to control the temperature. About 1000 ma. of diathermic current were used. This entire procedure was accomplished under scopolamin and morphin anesthesia. No general or local anesthetic was necessary. No urethral drainage was instituted, the patient urinating normally after regaining consciousness.

Sections removed before coagulation by the actual cautery showed a squamous celled carcinoma with active, cellular changes and many mitotic figures. The report by Dr. Mary Lincoln was that of an epidermoid carcinoma.

Two days later 1000 mgm. hours of radium radiation was effected by a pack in the left inguinal and femoral regions. This dosage was repeated over the right inguinal region five days later.

At the end of ten days the patient returned to her home. She did not report again for two months. During the last month of this time she had no hematuria or dysuria and gained fourteen pounds in weight.

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On May 21, 1922, the urethra was inspected. Complete local healing had occurred with the exception of an area the size of a five-cent piece in the right upper urethral quadrant. On May 27, 1922, this area was completely coagulated in the same manner as that used to destroy the original growth. At this time the length of the urethra was .5 cm., but perfect urinary control was maintained by the internal vesical sphincter.

The patient was not seen again until August 13, 1922. Examination of the urethral and vulval regions showed complete healing of these areas. There was a moderate amount of cystocele but urination was normal except for slight dribbling at the completion of the urinary act. At this time 500 mgm. hours of radium radiation was given over both inguinal regions. The lymph nodes at this time were not more enlarged than at the original examination.

X-rays of the pelvis and lumbar region at this time showed no evidence of metastasis. In spite of this an unfavorable prognosis was given and the family instructed that metastases would undoubtedly develop later on. The patient was unable to come to the city for deep x-ray radiation which was advised at this time.

In November a communication from her doctor stated that the inguinal glands were greatly enlarged and painful and that the left leg was swollen and edematous. The patient gradually declined and died on December 16, 1922. During this time she retained urinary control and had no local recurrence.

Case II: Ada J., a widow, aged 72 years, presented herself October 2, 1923, complaining of a gradually increasing difficulty in urination for the past eighteen months. Frequency during the day had become intolerable and during the past two months considerable active hemorrhage had preceded and followed the urinary act.

Examination showed an undernourished general condition, without evidence of cardiac, pulmonary or abdominal disease. Blood pressure was 140 systolic and 90 diastolic. Hemoglobin was 65 per cent with 3,500,000 erythrocytes and 9,000 leukocytes. The differential count was normal.



PLATE XXVI

Drawing made to show urethral region as seen six months after destruction of tumor by diathermy. The entire region is completely healed and there is no evidence of local recurrence. The urethral canal is only 0.5 cm. in length but entire sphincter control is maintained.

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Local examination showed a senile vulval atrophy with normal vaginal and pelvic findings. The urethral meatus was entirely obscured by an annular rosette of protruding vascular tumor tissue. The latter was 2.5 cm. in diameter and projected 1.5 cm. beyond the normal surrounding tissue.

This tumor had the clinical appearance of the second type of urethral malignancy; a periurethral indurated tumor with a tendency to involve the surrounding tissue laterally and thereby occlude the urethral canal.

On vaginal examination the induration seemed limited to the distal two-thirds of the urethra and the underlying structures about the pubic ramus were freely movable. No inguinal or femoral adenopathy was apparent. Residual urine amounted to 120 c.c. on two separate examinations.

On October 8th operation was performed at the Washington Boulevard Hospital. Scopolamin and morphin anesthesia was sufficient for the entire procedure. The inactive electrode was placed over the suprapubic region and the entire growth was slowly coagulated using a flat disk as the active electrode. A gloved finger was held at the internal vesical orifice and the tumor tissue pushed upward and forward during the destruction. The coagulation included an area of normal tissue surrounding the tumor and after this was completed the urethral lumen measured 1.0 cm. A mushroom catheter was placed in the urethra.

Tissues removed by the diathermy knife, prior to the coagulation *en masse*, were sectioned and showed "squamous celled carcinoma."

The patient made an uneventful recovery and urinated normally on the eleventh day. Follow-up treatment consisted entirely of passing urethral sounds, to prevent stricture of the bladder neck, and the local treatment of a persistent cystitis.

Examination on July 3, 1924, showed the following: The patient has gained thirty pounds in weight; urination is free and painless; there is no residual urine; no nocturia or frequency; the urethra is markedly retracted but there is complete control and no dribbling or incon-

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tinence; there is no evidence of recurrence and the bladder is normal on cystoscopic examination.

While it is less than a year since the coagulation of this tumor there is every evidence that an apparent cure has been obtained. At no time have the inguinal or femoral nodes been palpable.

It should be emphasized that for several months after the coagulation of tumors of the female urethral region sounds should be passed to prevent stricture and contraction.

CHAPTER TWELVE

TUMORS OF THE BLADDER

Historical

Prior to 1872 there was but scant reported knowledge of the subject of bladder tumors. During the greater part of this period diagnosis was made only at autopsy. The post-mortem findings were poorly described and neoplasms were frequently confused with syphilitic lesions. This latter condition was widely prevalent upon the Continent after the Fifteenth Century.

From 1872 to 1896 there was a gradual enlightenment on this subject. Syphilis was more frequently excluded by the application of antiluetic treatment. As complete autopsy examinations became more commonly employed the differentiation of new growths from prostatic hypertrophy and bladder stone was recognized. Physicians began to correlate the autopsy findings with clinical symptoms in an attempt to make a correct ante-mortem diagnosis. During the latter part of this period the advent of the more improved microscopes, together with a gradually increasing knowledge of bacteriology, made possible the exclusion of bladder tuberculosis. Methods of treatment were crude and were largely directed at the relief of vesical neck obstructions.

From 1896 to the present time the rapid progress made in the diagnosis and treatment of vesical tumors has been largely coincident with the development of the cystoscope. Where syphilis might complicate the picture, the introduction of the serum reaction of Wassermann (1905) aided greatly in the differentiation.

Although Nitze introduced the cystoscope in 1879, it did not come into common usage for several years. How-

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ever, in 1896 Nitze reported the first series of bladder tumors successfully treated through the cystoscope by means of a hot wire. This was followed by the reports of Edwin Beer in 1910. Beer's⁵⁷ method was adopted by urologists in all parts of the world and owing to the fact that he avoided any cutting procedure the method was more easily applied. His method has been successful in a large number of cases.

Coincident with the improvement in the treatment of vesical tumors, pathological study of these tumors received additional attention because many tumors after being destroyed by "fulguration" recurred. This study revealed the fact that many neoplasms while seemingly benign were in reality malignant and the mere act of cutting, snaring or burning the exposed tumor mass was not sufficient to allay its malignant tendencies. We believe that a careful analysis, embracing twenty years of experience in the treatment of bladder tumors, will show that the method of excision has failed to effect a permanent cure except in very rare instances. Up to the present time, x-ray radiation has not been a successful therapeutic measure.

The answer as to whether or not radium has been successful will be left to our confreres, who are working most diligently to perfect a method for curing bladder cancer.

In the following chapter we will describe in detail the technic which we use in the treatment of vesical tumors by thermo-electrocoagulation. This will be supplemented by our case reports.

Since our earlier experience made us somewhat skeptical of the value of radium as an adjunct to thermo-electrocoagulation we have withheld this measure for the past two years. In this way we may know the exact value of diathermy unaided by other, as yet unproven, methods.

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Classification of Bladder Tumors

The following classification as originally proposed by Kuester and Albarran, with the additional modification made by one of us, is as follows:

I. Neoplasm

1. Tumors of connective tissue origin

a. *Benign*

Fibroma

Myoma

Fibromyoma

Angioma

Rhabdomyoma

Myxoma

Chondroma

b. *Malignant*

Sarcoma

2. Tumors of epithelial origin

a. *Benign*

Adenoma

Papilloma

Cystic tumors

b. *Malignant*

Carcinoma

Adeno

Squamous

Scirrhus

Papillary

3. *Tumors of obscure origin*

Hydatid cysts

Dermoid cysts

Cholesteatoma

II. Granuloma

4. *Tumors of infective origin*

Secondary lues-condyloma

Tertiary lues-gumma

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According to Geraghty,⁵⁸ modern statistics have proven conclusively that the papilloma is by far the most frequent tumor of the bladder and *if it is further considered that practically all papillary carcinomata represent the advanced malignant degeneration of tumors, which in the early stages were papillomata*, some idea of the preponderance of this type of vesical neoplasm can be obtained. *This potential malignancy, we believe is the most important feature in the destruction of vesical tumors.*

SYPHILIS SIMULATING BLADDER TUMORS

From the case reports collected from the literature, it is apparent that syphilitic lesions may cause growths in the bladder which produce all of the symptoms and appearance of vesical tumors. In order that this condition may be more keenly recognized it seems pertinent to briefly review the conditions that may cause vesical syphilis.

Syphilis of the bladder manifests itself in the following ways:

1. Secondary period: During the time of the generalized eruption, it is not uncommon to find the bladder studded with discrete papules, similar to those appearing on the skin. These findings have been reported by numerous observers. There is also a form of *vegetating syphiloderm* which throughout the literature has been described as "gumma of the bladder," except by Den-slow.

If one considers that during the period of secondary invasion all the tissues of the body are invaded by the spirocheta pallida, one may easily assume that that which occurs on the skin may easily happen on other surfaces of epithelial character. It may easily be conceived that the changes which occur in a papule on the skin on a moist surface may occur on the moist mucous surface

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of the bladder, at any time after the primary invasion. This moist, papular syphiloderm may occur thirty years after a primary lesion when no treatment has been used.

The bladder offers a warm, moist bed for the growth and development of the spirocheta, and the thin mucous membrane of the bladder may be regarded as resembling fairly closely, so far as the condition which it offers for the growth of the organisms is concerned, the condition about the anus. The moist papular syphiloderm instead of becoming flat occasionally becomes warty and papillomatous. Several lesions may coalesce and a large cauliflower mass may develop which we may term a *vegetating syphiloma of the bladder*.

2. *Tertiary period*: Gumma of the bladder simulates the ulcerative form of papillary carcinoma. This is especially manifest when they are both broken down and covered with mucus. As these tumors may occur during the later periods of life, the time when malignancy generally occurs, a differential diagnosis is important. In arriving at a differential diagnosis one should consider the age of the patient, the history and the possibility of specific infection. In this connection it should not be forgotten that carcinoma may co-exist with syphilis and the presence of a positive Wassermann reaction therefore is not necessarily conclusive that malignancy is not present.

DIAGNOSIS

In order to effect a cure in vesical cancer, an early diagnosis is imperative. We all know that the first cardinal symptom of neoplasm of the bladder is hemorrhage. If the laity and the medical profession at large could only realize that hematuria is an even more dangerous symptom than hemoptysis, more tumors would be recognized early, treatment instituted, and the prog-

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nosis rendered more favorable. Unfortunately, this important symptom is not evaluated in its true significance.

SYMPTOMS

Hematuria

The cardinal symptom of vesical tumor is hematuria. Frequently it is the only symptom present, but its absence does not rule out bladder tumor. Recently we removed an extensive papillary carcinoma in a woman, thirty-five years of age, in whom there never had been any macroscopic blood in the urine.

The bleeding may be scanty or profuse, appearing suddenly or ceasing abruptly. Frequently the bleeding is accentuated by lifting or exercise. When the tumor is situated near the internal urethral orifice, bleeding may accompany each act of urination.

The voided urine may be bright red or coffee ground in color, the latter due to bladder retention which allows the clots to disintegrate.

Since hematuria is such a frequent and often the only symptom of bladder tumor, particularly in its early stages, it cannot be too strongly emphasized that this symptom calls for immediate investigation by means of the cystoscope.

Pain

Painful and frequent urination are common symptoms of bladder tumors. If they occur early in the symptom-complex, they are generally the result of infection, either introduced from without (after examination) or to pyelitis with secondary cystitis, the former originating from an obstructed ureteral ostium. Secondary infections may follow obstruction at the vesical neck and frequently there may be considerable residual urine in the bladder.

Where the growth has infiltrated the bladder wall extensively, pain is always present. This is more marked

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when bone metastases have occurred, in which event it may be radiating in character often extending down the sacrum to the thighs and legs.

As many of the tumors occur at or near the ureteral opening, there is frequently an obstruction to the ureteral flow and as a consequence there is produced back pressure on the kidney with resulting pyelitis, which may be attended by renal colic, chills and fever.

The average patient with vesical tumor if seen early in the course of the disease does not look or feel sick; in fact, many individuals go for long periods of time enjoying perfect health and it is only after an attack of bleeding that they feel alarmed. It is during these attacks that the patient is fortunate if his or her physician seizes the opportunity to have the bleeding investigated rather than to prescribe some placebo which will give the patient a false sense of security until another hemorrhage occurs. Seen later when the malignancy has begun to advance, these patients are pale, cachectic, nervous wrecks, not only from the torture of the urinary symptoms but from the toxemia of the disease.

Cystoscopic Differentiation

As studied with the cystoscope syphilis simulates the papilloma so closely that it is impossible at times to differentiate between them. In passing a cystoscope over a vegetating syphiloma of the bladder one is impressed with the similarity to bullous edema. However, by carrying the cystoscope to the border of the mass, the growth in uniform palisades can be differentiated from the normal bladder. The mass is freely movable. So far as the surface portion of the growth is concerned, the papillae rise and fall under the slightest pressure from the distal end of the cystoscope. The points of the papillae are arranged in peaks and are of a silver gray color, due to their distention, which causes them to be translucent

under the cystoscopic light. Looking across this mass through a McCarthy cysto-urethroscope, the papillae look more yellow from the retained serum under the mucous membrane. Seen later and after continuous treatment, the round and oval papillae show as delicate, pearly, translucent fingers, resembling stalactites. The cysto-urethroscopic picture may be compared to looking over the uneven surface of a lake, the peaks of the waves representing the papillae, perfectly transparent at their apices and so soft and delicate that they may easily be pushed over with the instrument.

We have been taught that all the papillomata are potentially malignant and that this malignancy increases as age advances. While this is true in a measure, we must not lose sight of the fact that malignancy appears in the young as well as in those of more advanced years.

It is impossible in those cases that present themselves early for cystoscopic examination to determine whether the papilloma is benign or malignant. Unfortunately, many cases come for examination when the malignant changes are advanced and infiltration of the bladder wall has occurred. It is at this period that cystoscopy will often disclose all we need to know, while a biopsy performed at this time is only of scientific interest and may be a dangerous procedure.

The salient features of a malignant neoplasm of the bladder, as viewed through a cystoscope are:

1. The changing of a papillomatous tumor into a sessile growth.
2. Early necrosis or erosion of a tumor mass that has not been fulgurated.
3. Presence of accessory tumors slightly adjacent to a central tumor, which may or may not be associated with bullous edema.

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4. In the absence of a positive source of infection, the presence of a severe cystitis. This condition associated with a bladder tumor is often indicative of malignancy.

Palpation

Abdominal palpation of bladder tumors is always difficult and frequently impossible. Occasionally, however, when the tumor involves the vertex its outline may be felt. Since at least one-half of the tumors occur on the base or lateral walls of the bladder, much valuable information can be obtained by rectal examination in the male. Here, the infiltration can often be distinctly palpated. In the female the vaginal examination, as a rule, reveals the extent of the growth more distinctly than the rectal examination does in the male.

Röntgenography

No examination should be concluded without an *x-ray* examination of adjacent bony parts for metastases. If extension has occurred, the prognosis is grave and only palliative relief can be expected.

Diagnostic Excision

The practice of excising a piece of tumor for diagnosis has been in vogue for many years. It made no difference whether the tumor originated in the bladder, uterus or breast, the main idea was to make a diagnosis, without considering that the prognosis might be jeopardized by this procedure.

We are all familiar with the controversy that has arisen at times, between clinicians and pathologists, over the malignancy or benignancy of a given tumor, because the portion removed may show no typical malignant changes while the remainder of the tumor may be definitely cancerous.

The prevention of metastases should ever be in mind in choosing the ideal type of treatment for tumors of

the bladder. It seems best not to attempt to excise a piece of tumor if the mere excision may be the cause of transplantation metastases. If it becomes necessary to excise tissue for diagnosis, the cautery method should be used.

We believe that in most tumors of the bladder it makes very little difference, so far as the clinical course is concerned, whether a piece is taken for diagnosis or not. In practically all cases palpation, cystoscopy and x-ray examination, if intelligently performed, give all the positive information that is necessary.

Treatment

A careful review of the literature points to the fact that the treatment of bladder tumors by excision is most discouraging. Since the treatment of malignant tumors by excision is at best precarious and uncertain, is it not better to attempt the development of a method that minimizes the possibility of metastases?

We assert that no tumor, whether benign, potentially malignant or malignant should be removed by excision.

If diathermy is not available, the electrically heated soldering iron is superior to any cutting procedure.

Diathermy has a distinct advantage over all methods used in the destruction of tumors, whether benign or malignant, for the following reasons: It is absolutely bloodless if a flat or blunt electrode is used. It not only insures the total destruction of the mass, but also sufficient coagulation of the tissues in the immediate neighborhood to minimize the possibility of cell implantation. Vascular structures situated near the vicinity are sealed, thereby lessening absorption. On this account, shorter convalescence is insured.

On account of the extensive formation of scar tissue that is formed after the use of diathermy, nature's

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method of limiting the spread of the malignancy is enforced; as a consequence, the neighboring embryonal cells are destroyed.

Experience has led us to believe that the treatment of bladder tumors may best be generalized as follows:

1. Benign papillomata (apparently so on cystoscopic examination). If there are but few papillomata and they are easily accessible, transurethral thermo-electrocoagulation (diathermy) should be employed, using the bipolar method and as large an active electrode as it is possible to pass through an operating cystoscope.

2. Multiple benign papillomata and tumors inaccessible transurethrally. Suprapubic cystotomy followed by thermo-electrocoagulation (diathermy), with the bipolar current, is the method of choice.

3. Carcinoma. These tumors are treated by the same method as multiple papillomata except that the diathermy coagulation is carried out more slowly and a wider area of apparently normal tissue is included in the destruction.

4. Tumors involving the ureteral ostium. Considerable literature has appeared relative to the treatment of the ureter when its ostium is involved in a vesical carcinoma. About four years ago we observed a vesical carcinoma that involved the left ureteral opening. The neoplasm had been present for several years and there was extensive involvement of the bladder floor which included the transvesical portion of the ureter. The tumor was subjected to thorough destruction by diathermy and no attempt was made to transplant the ureter. We were surprised some months later, when on cystoscopy it was found that the ureter was "burned back" fully an inch and that it was perfectly patulous and functioning normally.

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Lower⁴⁵ has emphasized that the ureter passes through the bladder wall for a considerable distance and he has devised a unique method of excising the intramural portion of the ureter when it is involved in papillary carcinoma.

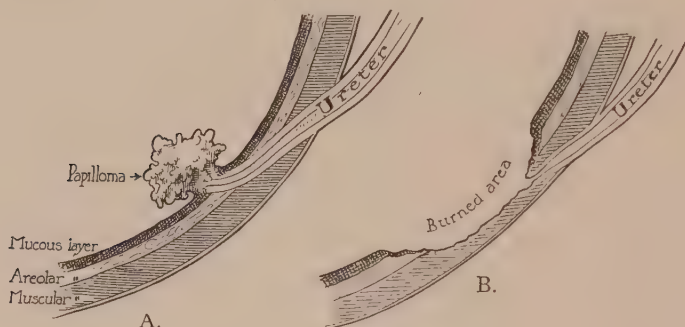


PLATE XXVII

A. Diagrammatic drawing showing ureter passing through the bladder wall, with its ostium obstructed by a papilloma.

B. The same view showing how the ureter is "burned back" by means of diathermy, including removal of the papilloma.

Since we feel that all cutting procedures should be avoided in the region of bladder involvement, we have adopted the method of "burning back" the ureter by diathermy in place of transplanting it. This we believe is rational in view of the excellent results obtained in our experimental work on dogs followed by repeated observation in our clinical cases. If the ostium contracts later, it is relatively easy to enlarge the opening by slitting the meatus with an operating scissors or by incising the mucosal scar with the special diathermy electrode devised for this purpose. In the few instances where contraction occurred these procedures, followed by the passage of ureteral bougies, have resulted in a more normally functioning ureteral opening than is usually found after transplantation of the ureter.

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TECHNIC OF TREATMENT

TRANSURETHRAL METHOD

Anesthesia

In order to keep the patient quiet, fully relaxed and free from pain, we have found scopolamin-morphin anesthesia to be ideal for this class of work. As a rule, we give 1/6 gr. morphin and 1/150 gr. scopolamin at 6:30 A. M., 7:30 A. M., and 8:30 A. M., when operation is to be performed at 9 A. M. This method of anesthesia allows a slow deliberate coagulation of the tumor area and repeated washing of the bladder for more careful inspection.

Situation of the Tumor in Relation to the Position of Inactive Electrode

If the tumor is situated in the lower half of the bladder we place the inactive electrode beneath the sacrum. If in the upper half of the bladder the inactive electrode is placed over the bladder just back of the symphysis. This will permit the passage of the current in a direct line between the active and inactive electrode, and thus insure better heat penetration.

The largest active electrode that will pass through an operating cystoscope is firmly placed in contact with the area to be destroyed. With the foot switch easily accessible, the current is turned on and slow coagulation begun. As soon as the current is stabilized, it need not be readjusted. The tumor as well as its base and some of the surrounding normal mucosa are "cooked white." In no instance should sparking with resulting carbonization take place as heat penetration is desired rather than superficial destruction with carbonization, as has been the custom heretofore.

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We wish to emphasize that pathological cells offer less resistance to heat than do normal cells and if we expect to completely and successfully destroy a slumbering malignancy we must infuse heat into every part of the growth.

If after long and careful coagulation the tumor disappears only to recur after several months, no time should be lost in performing suprapubic cystotomy, followed by a more thorough application of heat with a flat electrode.

SUPRAPUBIC CYSTOTOMY

Thermo-electrocoagulation (Diathermy) Using the Bipolar Current

Preparation of Patient

As a general rule, patients afflicted with vesical tumors need no special preparation, but in individuals where there are symptoms of urinary obstruction with urea nitrogen retention, it is wise to establish some form of bladder drainage to relieve the back pressure on the kidneys.

Our routine is as follows: Shave and prepare for suprapubic cystotomy. No fluids after 2 A. M., no breakfast, high soap suds enema at 6 A. M. Scopolamin-morphin as directed above. In the latter regard all sensory stimuli must be eliminated. After the first injection the room should be darkened; the ears plugged with cotton and the eyes covered. The patient should be transferred gently and quietly to the operating room after the third injection.

Having filled the bladder with boric solution, the field for operation is prepared. The diathermy machine should be adjusted and ready for use. The indifferent electrode (6 x 6 inches) is placed beneath the sacrum. It is well to cover the electrode with shaving soap or



PLATE XXVIII

Illustrating the method of coagulation of cancer of the bladder. The inactive electrode is beneath the sacrum. The gloved finger inserted into the rectum or vagina is the best guide in determining the degree of heat penetration.

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interpose a gauze pad saturated in hypertonic salt solution. The usual incision for suprapubic cystotomy is made and the bladder is mobilized as completely as possible. In order to keep the wound as dry as possible and to avoid transplanting any tumor cells, all of the boric solution is now drained from the bladder. When this is completed the patient is put in the Trendelenburg position and the bladder opened. At this point and from here on every effort should be made to *avoid transplanting tumor cells on raw or cut surfaces*. Towels should be placed over all open surfaces and kept there until the tumor is destroyed and its base well coagulated.

If previous cystoscopic examination shows that the tumor is near the vertex, the bladder opening should be made laterally or transversely. If there is any danger of incising the growth when opening the bladder the incision should be made with the diathermy knife. After the bladder is opened careful inspection readily shows the location of the growth.

After the opening is enlarged, a self-retaining bladder retractor is inserted, provided the blades do not impinge upon the tumor. In this event large flat bladder retractors are substituted.

Destruction of the Tumor

Where the tumor or tumors have an elongated pedicle, we have frequently placed a noose around the pedicle, drawn it tight and then severed the pedicle by means of the diathermy knife (active electrode). Later the stalk is treated by a thorough infusion of heat, using a flat active electrode 2.5 cm. in diameter (Plate XXV) and taking great care to not only treat the base but going well outside of any evident tumor growth.

It has been our endeavor to make electrocoagulation a safe procedure. There is always a question as to how

much one dares to coagulate without perforating the bladder wall. We have found that the gloved finger in the vagina or rectum may be held immediately beneath the tumor and will give a fairly accurate index of heat penetration. When the heat can no longer be tolerated by the gloved finger the coagulation is discontinued. Heat induction may be resumed again if the whole area is not sufficiently coagulated, but it must be discontinued as soon as it reaches the extent of tolerance to the gloved finger.

All coagulation must be done slowly. Sufficient time must be given not only to heat the part of the bladder wall known to be involved but also any part that one suspects might possibly be involved.

Once the current is stabilized it will remain fairly constant. Control of the current by a foot switch, operated by the surgeon himself, is necessary for the proper application of the electrode.

If on opening the bladder one finds a large, friable, sessile tumor great care should be taken not to disturb the growth lest hemorrhage may occur. As gently and as quickly as possible the entire surface should be coagulated. When the mass is sufficiently coagulated on the surface to arrest any bleeding, the deep penetration of heat can be continued slowly and carefully. We have frequently taken from fifteen to twenty minutes to complete the coagulation.

The bladder is closed by interrupted sutures of catgut, sewing in a retention catheter for drainage. Each layer is sutured and then drained separately by small split rubber drains.

We have found scopolamin-morphin anesthesia to be ideal for thermo-electrocoagulation, as frequently no supplementary general anesthetic is necessary.

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Postoperative Care

Immediately following the operation from 700 to 1000 c. c. normal saline solution is given subcutaneously, or a solution of 4 per cent glucose in normal saline solution is given intravenously. This is repeated in six to seven hours. No fluids are given by mouth for the first twelve to fourteen hours. After this time the patient is given large quantities of fluid if there is no nausea and no evidence of gastric dilatation.

Following this method there is a minimum of shock. Many of the patients are not at all nauseated. If water by mouth is withheld long enough they start from the second day toward a speedy recovery. The subcutaneous drainage is removed in from twenty-four to forty-eight hours. No irrigation of the bladder is necessary as the patient receives enough fluid to facilitate free drainage. When the coagulation has included an ureteral orifice, there may be some blocking of the ureter on the affected side with an attending pyelitis, but the ingestion of plenty of water will soon wash the opening clear and the symptoms will quickly subside.

After-Care

The slough that follows electrocoagulation usually comes away about the eleventh to the fourteenth day but over the entire area there may remain some roughening of the mucosa with adherent fibrin and this may be present for some weeks. In order to inspect the ureteral orifice, cystoscopy should be performed not later than four to six weeks after operation. Usually the ureteral opening on the affected side will be "burned back" and patulous; if it is not, it should be opened before a narrow contraction of the ostium takes place. Up to the present time this has been the only complication that has occurred following electrocoagulation of tumors situated on the floor of the bladder.

DIATHERMY

During the past five years we have treated twenty-eight cases of carcinoma of the bladder by diathermy. Of the first ten cases, five received topical radium applications as a supplement. The remainder have received no treatment other than diathermy, except for one very advanced, hopeless case in which deep x -ray radiation was used as an adjunct, but without success.

Five cases had transurethral treatment only; four cases were subjected to a combination of transurethral and suprapubic treatment, and nineteen had suprapubic diathermy alone. In three cases the actual cautery was used before diathermy for the purpose of removing tissue for microscopic examination. More recently this procedure, when deemed advisable, has been carried out with the diathermy knife.

In this series there was one hospital death. This occurred forty-eight hours after operation from acute gastric dilatation and cardiac failure in a man in whom the prognosis as to tumor destruction seemed most favorable. The immediate operative mortality, is, therefore, 3.5 per cent. In the remaining twenty-seven cases there have been three deaths; one in an advanced carcinoma of the bladder treated by diathermy and radium, where marked relief was obtained for one year, the patient dying two years after operation with a recurrence in the bladder. The second death occurred in a man who presented himself complaining of bloody urine, but who refused cystoscopy. One year later he again sought relief and cystoscopic examination then showed a very extensive carcinomatous involvement of the bladder. Diathermy was used suprapubically, but it was impossible to coagulate all of the tumor masses. Deep x -ray therapy was used but the patient died one year later of bladder and lumbar gland carcinomata. The third death is a more recent one and occurred from generalized car-

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cinoma metastasis four months after the suprapubic destruction of a small, infiltrating carcinoma of the bladder. There was no vesical recurrence one month prior to death.

Of the remaining twenty-four cases, twenty-two are free of recurrence after six months, twenty after one year, fifteen after eighteen months, twelve after two and one-half years, and seven after four years. One patient reported June 1st, 1924, who had been treated for an apparently incurable carcinomatous involvement of the bladder on December 2nd, 1922. He had been in excellent health until a few days before, when he again noted blood in the urine. Cystoscopy showed the floor of the bladder, which had been the primary site of multiple infiltrating carcinomata, to be normal. There was an area the size of a dime on the left anterior aspect of the vesical neck, which was obviously a papillary carcinoma. This patient was subjected to suprapubic cystotomy and coagulation of the growth on June 27th, 1924. At this time the entire right half of the trigone was seen to be replaced by a smooth, greyish, fibrous tissue through which the right ureter functioned normally.

We are not including in this report four cases which were operated upon in the last four months, although cystoscopy now shows both ureters to be patulous and the bladder uninvolved.

Of the twenty-four cases which are symptomatically and objectively well at the present time, five had been operated upon elsewhere from one to three years prior to consulting us. All of them showed recurrence of carcinoma after excision; three were very extensive and two appeared favorable. One other patient had been subjected to three suprapubic operations in which excision, the actual cautery and radium had been of no avail. When first seen by us the bladder capacity was one

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ounce. Two diathermic applications through the cystotomy wound were given, four months apart. It is now three years and eight months since her last operation; she is free of recurrence and has a bladder capacity of eight ounces.

Of the twenty cases in which no recurrence has taken place, all were clinically and objectively malignant. Of these fifteen were verified by microscopic examination. Sixteen of the twenty cases had trigonal and ureteric orifice involvement.

In addition to apparent cure, the very satisfactory ureteral and bladder function is notable. The smallest bladder capacity in any of these patients is six ounces and practically all have regained normal capacity and are free from all distressing urinary symptoms. In no single instance have we burned through to the rectum or to the vagina.

We wish to cite a few case histories descriptive of the successful management of these cases.

Case I: Mrs. I. P., aged 36 years, housewife, was referred on May 1, 1919. She gave a history of frequent urination and dysuria for the past fourteen months. Bloody urine had persisted for three months. General health otherwise was excellent. Cystoscopy showed a papillary tumor 6 cm. in diameter just above the right ureteral orifice. The top of the tumor showed definite necrosis and the mass was surrounded by diffuse ulcerations. At the base of this tumor, but posterior and superior to this region, were four papillary tumors about 0.5 cm. in diameter.

Transurethral fulguration of these tumor-bearing areas was performed repeatedly from May until September. During this time there were many slight hemorrhages and finally a rather profuse one occurred, so that it was deemed advisable to open the bladder and deal more radically with the tumors. Operation was performed on October 23, 1919, at the Evanston Hospital. A suprapubic cystotomy was performed under gas and

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oxygen anesthesia. Massive coagulation by diathermy and the largest growth was removed at its base with the actual cautery followed by diathermic coagulation.

Microscopic Diagnosis: (Dr. J. L. Williams) Papillary carcinoma of the bladder.

Convalescence was uneventful. This patient is absolutely well, bladder capacity is normal, and she has had no recurrence as indicated by normal cystoscopic findings and her continued excellent general health.

Case II: Maria G., aged 61 years, housewife, presented herself on November 5, 1921, complaining of frequency of urination for ten years; hematuria for three years. Two years previously she had a suprapubic operation at Mercy Hospital, with excision of "papilloma" and cauterization of the base. Profuse hemorrhage recurred in three months.

Patient stated on November 5, 1921, that she could not stand it any longer. Urination every few minutes was accompanied by severe pain. Her general health was excellent. Plain x-rays showed no evidence of bone metastases. Cystoscopy showed a bladder capacity of one ounce. The bladder was filled with tumor masses, ulcerating and necrotic and there was marked bullous edema everywhere.

Operation was performed on November 10, 1921, at the Washington Boulevard Hospital, under gas and oxygen anesthesia. A transperitoneal approach to the bladder was necessitated owing to the previous operations. When the bladder was opened tumor tissue was evulsed into the entire wound; this occurred a great deal as the fruity part of an orange would be expelled when the peeling was pressed upon.

It seemed futile to attempt any procedure with these extensive tumor mass areas, and in the presence of such a markedly contracted bladder. However, all of the accessible masses were coagulated with a very high degree of heat. At the completion of this procedure the interior of the bladder was so hot that it was with difficulty that the gloved finger could be held therein.

Microscopic Diagnosis: (Dr. Mary Lincoln) Papillary carcinoma of the bladder.

The patient made an excellent operative recovery and left the hospital in three weeks with a bladder capacity of three ounces. Cystoscopy at this time showed two necrotic, papillary masses on the left floor of the trigone about the region of the left ureteral orifice.

Topical applications of radium were given through an operating cystoscope and in January these masses seemed the same size although we had been able to increase the bladder capacity to six ounces.

Transurethral diathermy was performed on three occasions. At the end of one month from the last coagulation the patient returned, stating that she was in splendid health and that she could go four hours without voiding. Cystoscopy showed that the area of previous involvement that had been treated had healed completely and that there remained only one area of tumor involvement. This was situated on the anterosuperior wall just above the internal vesical orifice and was inaccessible to any transcystoscopic manipulation.

Because of the exceedingly remarkable improvement and the fact that this patient was symptomatically well after what appeared to be an utterly hopeless case, we decided to make a final attempt to destroy the last remaining bit of cancer tissue, since there was no evidence of metastases.

Operation was performed on March 23, 1922, under scopolamin-morphin anesthesia. A very difficult transperitoneal cystotomy was done and the contracted bladder opened above in such a way that the carcinomatous area at the bladder neck was thoroughly coagulated by diathermy.

The patient made a good recovery and has enjoyed excellent health ever since. She now has a bladder capacity of fourteen ounces, both ureters have been "burned back" but although large and gaping they have good ejectile tone. General health is the "best now in ten years" and she rises only once at night to void.

Cystoscopic examination on July 2, 1924, showed no evidence of recurrence.

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Case III: Walter T., aged 54 years, teamster, presented himself March 1, 1922. Three years prior to this time he had had profuse hematuria, with periodical associated dysuria and frequency. One year prior had suprapubic operation at the Cook County Hospital with excision of the tumors and cauterization of the bases. The hematuria recurred in six months and had gradually become so severe that the patient was very weak and had lost twenty pounds in weight.

Cystoscopy showed a large single papillary tumor with a base about four cm. in diameter occupying the entire right half of the trigone and excluding from view the right ureteral orifice. Otherwise the bladder was normal.

Operation at the Washington Boulevard Hospital on March 5, 1922, under scopolamin and morphin anesthesia. A suprapubic cystotomy with complete desiccation of the growth by diathermy; the right ureteral orifice was undoubtedly involved in the tumor mass but was coagulated with the tumor.

Microscopic Diagnosis: (Dr. Mary Lincoln) Papillary carcinoma of the bladder.

Cystoscopy in January, 1924, showed normal bladder without evidence of tumor recurrence. The right ureter had been "burned back" and is patulous.

The patient is working every day and in good general health. Since this time the patient has completely regained his former health.

Case IV: John B., aged 68 years, glass cutter, always in good health until June, 1921, when he had an attack of profuse painless hematuria. No further trouble until June, 1922, when the hematuria recurred.

Cystoscopy on June 25, 1922, showed a very large, sessile, papillary tumor occupying the entire right trigone and obliterating the right ureteral orifice.

Operation at the Evanston Hospital on June 30, 1922. A suprapubic cystotomy under scopolamin and morphin and local anesthesia. The entire tumor-bearing area was coagulated very slowly by high current diathermy.

Microscopic Diagnosis: (Dr. J. L. Williams) Papillary carcinoma of the bladder.

Convalescence was uneventful. Patient has been perfectly well with the exception of acute right pyelitis four months after leaving the hospital. At that time it was found that the ureteral orifice was constricted by the scar tissue, causing a temporary obstruction. This area was slit with an operating transcystoscopic scissors and subsequently dilated with ureteral bougies and no further trouble of this nature has resulted.

At the present time the patient is in excellent health and there is no sign of local recurrence, as evidenced by cystoscopic examination. Present bladder capacity is six ounces. Nocturia once or twice.

Case V: Ella S., aged 48 years, housewife, presented herself January 15, 1923, complaining of intermittent hematuria for the past nine years. During this time her family doctor had been treating her for "papilloma of the bladder" by washing out the viscus with antiseptic solutions. Recent development of pain and frequency made her seek further advice. Her general health had been excellent.

Cystoscopy showed an infiltrating necrotic tumor invasion of the floor and lateral wall of the bladder just posterior to the left ureteral orifice but not directly involving it. This mass occupied a segment of bladder equal to one-quarter of its circumference.

Vaginal examination showed a hard indurated mass in the region described above, but there was no encroachment on the anterior vaginal wall. Plain x-rays showed no evidence of bone metastases.

Operation was performed at the Washington Boulevard Hospital on January 20, 1923, under scopolamin and morphin anesthesia. A suprapubic cystotomy was done transperitoneally because of the adherency of the peritoneum over the entire left lateral bladder wall. It was possible to free this entire mass to the extent of making it accessible to deep slow coagulation by diathermy. It was obvious that the only way to destroy this growth was to coagulate it *en masse* and let it slough out.

Healing was completed on the fortieth day postoperative.

TUMORS OF THE BLADDER

Microscopic Diagnosis: (Dr. Mary Lincoln) Scirrhous and papillary carcinoma of the bladder.

This patient is absolutely well and without recurrence. Bladder capacity is fifteen ounces and she has no urinary symptoms.

Cystoscopy on July 9, 1924, showed normal bladder with normally functioning ureteral orifices. Patient now weighs forty-two pounds more than before operation.

CHAPTER THIRTEEN

CANCER OF THE PROSTATE

Cancer of the prostate is a fairly common disease and according to statistics occurs in from 15.5 per cent (Mayo Clinic) to 21 per cent (H. H. Young) of all prostates causing obstruction at the bladder neck.

As physicians become better trained and more skilled in urological diagnosis, it is highly probable that this serious affliction will be diagnosed earlier and in turn receive more rational treatment. It is not our purpose to enter into controversy with those who have had more experience in the various methods of treating this almost incurable disease, but rather to present a method for eradicating the malignancy without destroying the anatomical relations between the cancer and the prostatic capsule.

Anatomical Considerations

According to Quinby,⁵⁹ the apex of the prostate is supported by the deep layer of the triangular ligament. On each side is found the so-called lateral aponeurosis of the prostate. This runs from the descending rami of the pubis backward to join the rectum, and by it, the prostate is separated from the median margins of the levator ani muscle. It is closely applied to the sides of the gland and is united to it by the cellular tissue containing the vesical plexus of veins.

Behind the prostate, separating it and the seminal vesicles from the rectum, there is a transverse aponeurosis, known commonly as the fascia of Denonvillier. This layer is attached below and anteriorly to the apex of

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the prostate and triangular ligament and united above to the peritoneum, which descends between the bladder and the rectum. This last union is as marked as though there existed continuity of tissues and explains the constancy of the rectovesical cul-de-sac (Douglas' fossa). On each side of this fascia is attached the lateral aponeurosis described above. By its posterior surface it is but loosely attached to the seminal vesicles and to the true capsule of the prostate gland. The texture of this membranous layer is said to resemble that of the dartos. All these surrounding prostatic fasciae make up the prostatic bed and these serve to control the direction and spread not only of suppuration but also of malignancy in this area. Besides these aponeuroses described above, the prostate has a true capsule of its own which sends prolongations between the glandular lobes.

From the pioneer work of Lowsley,⁶⁰ we are informed that cancer of the prostate develops primarily in the posterior lobe and when the lateral and median lobes are involved, this occurs secondarily from an extension of the process in the posterior lobe.

According to Young⁶¹: "Carcinoma of the prostate develops many times where hypertrophy is absent in both median and lateral lobes; the growth following planes of least resistance continues upward beneath the trigone toward the seminal vesicles and does not easily break through the capsules which surround the lateral and median lobe."

The mucosa and submucosa of both urethra and bladder are very resistant to invasion, the constriction in the prostatic urethra often encountered during examination being due primarily to the crowding of the cancerous tissue up against the urethra and not to direct extension of the growth.

Cancer of the prostate may be of slow growth and remain for a long period well confined within the capsule of the prostate. Several years may undoubtedly elapse before periprostatic structures, seminal vesicles and trigone are greatly involved. Intravesical tumor growth is extremely rare and only occurs very late in the disease, and even then in a small percentage of all cases.

From the best authorities it is generally understood that the disease apparently remains well encapsulated for a fairly long period. Unfortunately, on account of its obscure position and often indefinable symptoms, its diagnosis is lamentably delayed.

From the foregoing and from a careful review of the anatomy of the prostate, we must look upon the prostatic capsules as anatomical barriers against the spread of the disease anteriorly and laterally. Since the rectum is so easily separated from the dense fascia which locks the cancer securely in its bed, it seems that the most rational method of attack is by the way of the perineum, for with proper exposure the cancerous tissue is brought directly beneath the finger without disturbing or in any way spreading the smoldering malignancy.

Symptoms and Diagnosis

The symptomatology of cancer of the prostate is almost identical with that of benign hypertrophy. Pain in the penis and perineum may be the first symptom noted but, as a rule, this is associated with frequency of urination and difficulty of urination, often accompanied with more or less urgency. As the prostatic urethra does not, as a rule, become involved in the cancerous process, hematuria is not a necessary cardinal symptom unless associated with benign hypertrophy.

Too little attention is given to the symptom of pain. It may be vague and very indefinite, in the back or re-

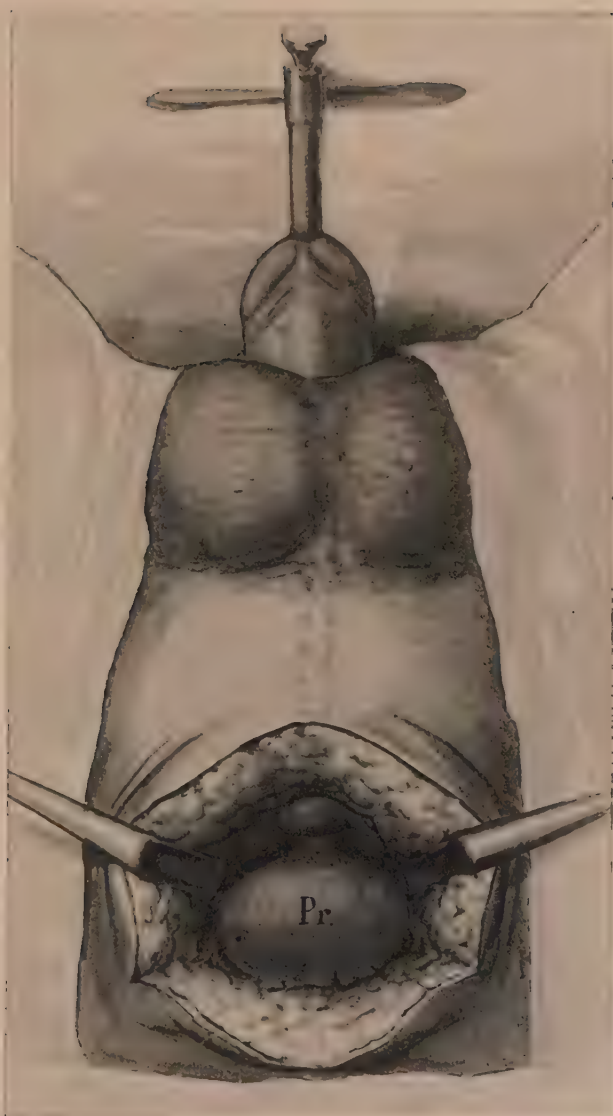


PLATE XXIX

Illustrating the perineal exposure of the prostate after the method of Young. By using the long urethral prostatic tractor it is unnecessary to incise the membranous urethra in order to expose the prostatic region.

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ferred to the sciatic notch, testicle, inguinal region, thighs or legs. In arriving at a diagnosis every referred symptom should be carefully noted and regarded with suspicion. It is this class of cases which so frequently goes without a positive diagnosis for a long time and in many instances resorts to futile manipulative therapy before the correct diagnosis is made.

Rectal Examination

It is only by careful routine rectal examination that the diagnosis of early carcinomatous involvement of the prostate can be diagnosed; whereas it helps us comparatively little in the benign hypertrophy, it usually establishes the diagnosis in malignant disease.

There is nothing so characteristic as the "stony hard" feeling so easily palpated by rectal examination. The involved portions of the gland are usually firmly fixed due to periprostatic inflammation.

The cancer area is, as a rule, rough and nodular and can be sharply demarcated from the surrounding healthy tissue.

In passing a catheter or cystoscope one is often impressed with a tightness in the posterior urethra; this constriction may be so narrow that the passage of any diagnostic instrument is not possible until the prostatic urethra has been dilated. No examination should be completed without a satisfactory cystoscopic examination and while the cystoscope is in situ the gland should be thoroughly examined per rectum as it is only by this method that careful and complete findings are possible.

Technic

Where there are symptoms of vesical obstruction, with urea nitrogen retention, due either to cancer of the prostate alone or to an associated benign hypertrophy, a

suprapubic cystotomy should be performed and the bladder put at rest until the patient is in the best possible condition for operation.

Where simple hypertrophy accompanies the malignancy in the posterior lobe no attempt should be made at the time of coagulation of the cancerous growth to disturb the benign adenoma. One must be sure that the cancer cells are all destroyed before completing the removal of the obstruction, less we hasten metastases, the one thing we wish to avoid in the destruction of all malignancies.

Perineal Prostatomy with Thermo-Electrocoagulation

Place the inactive electrode over the symphysis pubis with an intervening pad moistened well with hypertonic salt solution. Equip the active electrode with a flat disk (2.0 cm. in diameter).

Having exposed the prostatic bed sufficiently to permit easy access to all of the cancerous growth, the biopsy trocar (tissue taker) is next inserted into the growth and a piece taken for microscopical diagnosis. Immediately following this procedure the location of the puncture is thoroughly coagulated. This coagulation is then continued, not only over all the area known to be involved in the malignancy, but also to regions where there may be any suspicion of involvement. If the growth extends upward toward the vesicle on either side, the prostate may be pulled aside with a tenaculum and the disk electrode pushed to immediate contact with the growth. When this is completed the needle electrode is substituted for the disk as this permits a still deeper carrying of heat into the diseased vesicle and, with the distal finger inserted into the rectum as a guide, its direc-

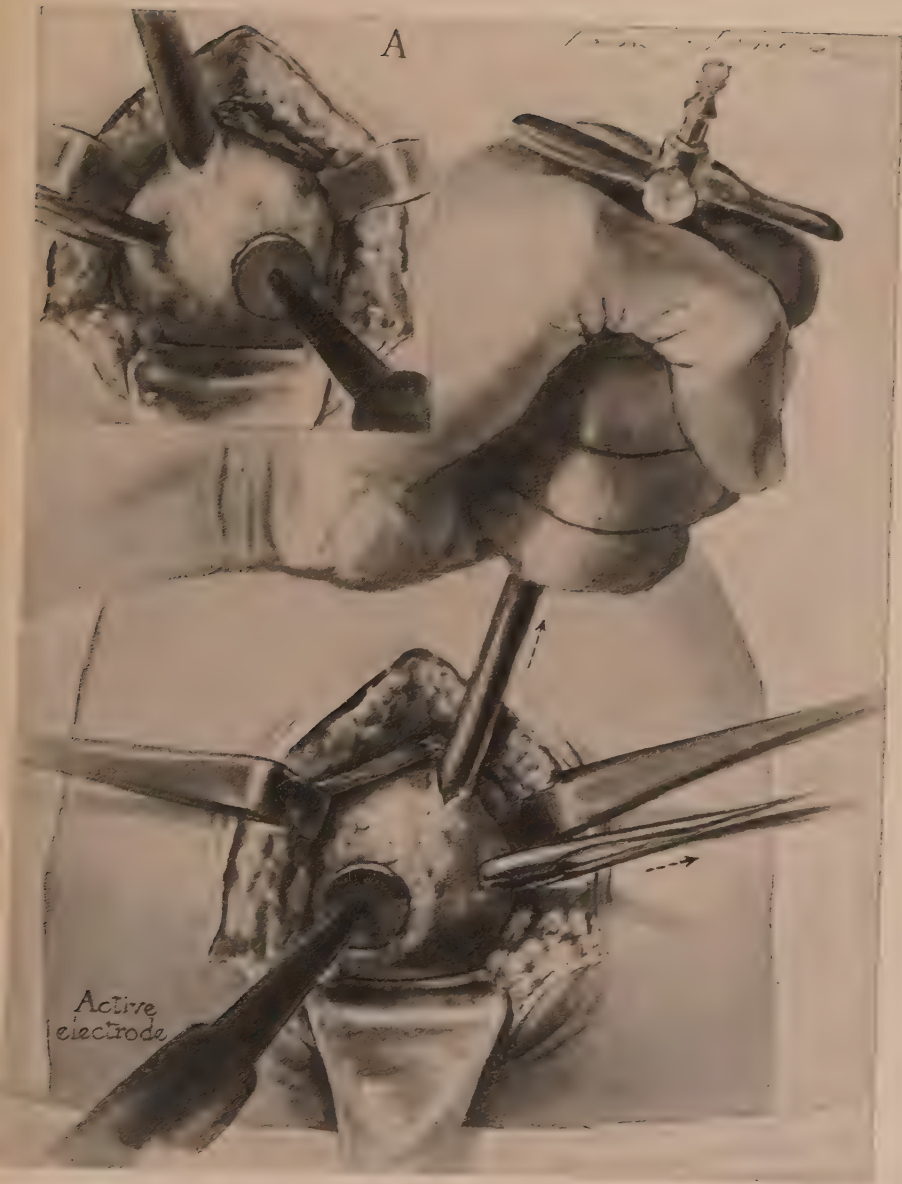


PLATE XXX

Illustrating the application of surgical diathermy to cancer of the prostate when the tractor has been introduced into the membranous urethra. The inactive electrode is placed over the supra-pubic region. The active electrode is in immediate contact with the fascia of Denonvilliers which overlies the carcinomatous area. 4. Shows the prostate pulled to the opposite side so that the entire gland may be coagulated.

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tion is more accurately controlled so that any danger of perforation through the rectal wall is avoided.

Thermo-electrocoagulation of the cancer in the posterior lobe should be done slowly and carefully. In order to keep the rectal wall from burning while using the flat disk electrode, sponges moistened with hypertonic salt solution should be placed immediately outside of the area to be coagulated. By placing the inactive electrode over the suprapubic region there is a direct path of heat transfusion which greatly facilitates the destruction of the growth.

If there is no benign hypertrophy complicating the cancerous growth an opening is made in the membranous urethra and a catheter is inserted into the bladder for drainage. Otherwise the drainage is continued from the suprapubic opening. The wound is next packed with strips of gauze and the skin is closed as in perineal prostatectomy. Drainage may be removed in twenty-four to forty-eight hours.

Postoperative Care

The care is the same as that following perineal prostatectomy.

As previously stated, when benign hypertrophy complicates the involvement in the posterior lobe, several months should lapse before an attempt is made to remove the adenomatous tissue. However, this should only be attempted after thorough röntgenologic data shows no evidence of metastasis and likewise no evidence of local recurrence.

It must be remembered that the resulting sclerosis following the diathermy is even more dense and uniform than that following x-ray or radium and resulting con-

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tracture of the internal urethral orifice is inevitable if there has been extensive coagulation.

When sclerosis has occurred we have employed linear cauterization (actual cautery) of the orifice through a suprapubic cystotomy. Following this the remaining portions of the obstructing lobes are slowly coagulated by diathermy. The frequent passage of urethral sounds assists in establishing rapid functional recovery.

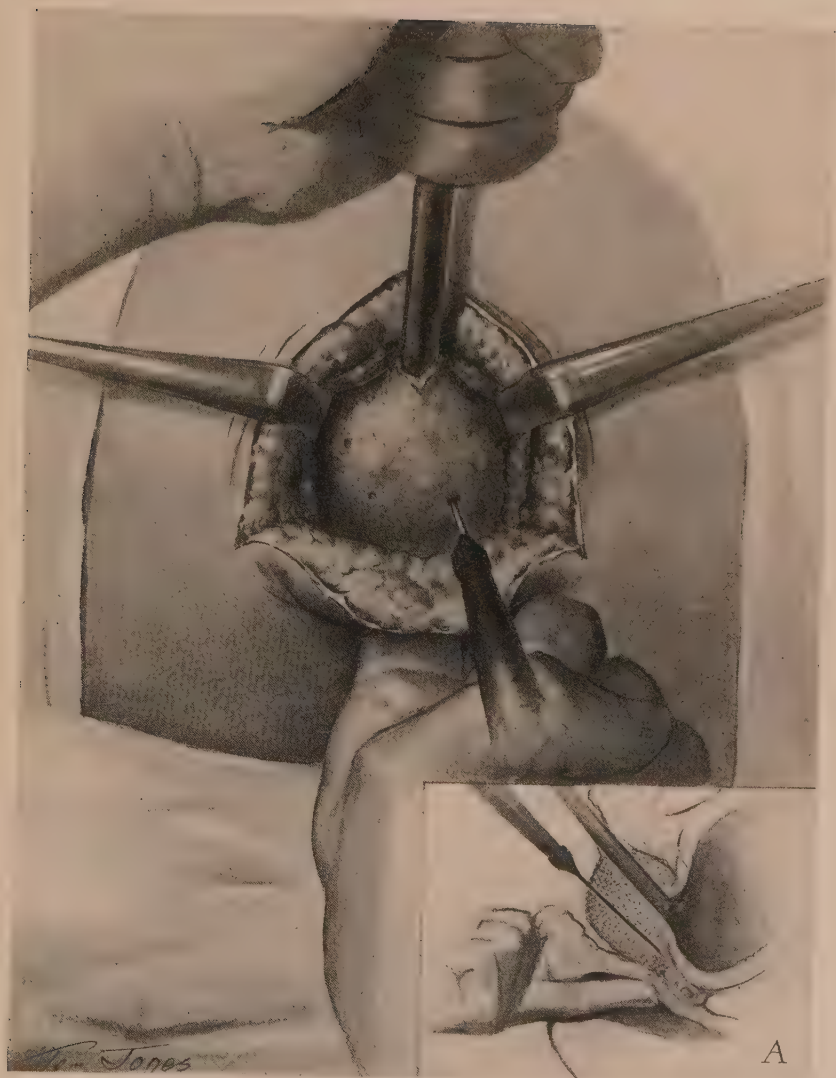


PLATE XXXI

Illustrating the final steps in the complete coagulation of the entire prostatic region. With a finger inserted in the rectum the needle electrode is guided into the depths of the carcinomatous area so that more complete heat penetration may be accomplished. *A*, Shows cross section of this procedure.

CHAPTER XIV

GENERAL CONSIDERATIONS ON THE TREATMENT OF ACCESSIBLE CARCINOMA

We do not feel that this treatise would be complete without mentioning briefly the excellent results which we have obtained in the treatment of neoplasms occurring in regions other than the genito-urinary tract.

After reading the foregoing chapters relating to the treatment of cancer of the genito-urinary tract, the following question comes readily to mind: If thermo-electrocoagulation destroys pathological tissue so efficiently, why is it not more extensively used in the treatment of keratoses, warts, and malignant growths in other parts of the body?

The only answer that can be made to this query is that there has been a general lack of knowledge on the part of the medical profession regarding the fundamental principles and the proper application entailed in the successful thermo-electrocoagulation of new growths.

The surgeon who has perfected what he considers an ideal technic for the excision of tumor-bearing areas has hesitated to undertake a method which presents such a radical departure from his own previously conceived ideas. He has persisted in his adherence to surgical excision even in the face of bitterly disappointing end results in the majority of his cases.

In a recent issue of *Radiology* (October, 1924), Rollin H. Stevens, writing on "Facts and Theories in Cancer Therapy," states: "Mention must be made of the great value of electrocoagulation in the treatment of malignant conditions in certain locations. This is perhaps the most valuable surgical agent against cancer that

we have. In all types of cancer about the mouth, nose and antra, we have found it exceptionally valuable. In squamous-cell carcinoma involving these areas, or large areas on the skin anywhere, we have found radiation by radium or x-ray often only partially successful, but electrocoagulation, skillfully applied, is very successful. It is astonishing how well large areas deeply involved with cancer can be made to heal satisfactorily by electrocoagulation, after every other agent at our command fails utterly."

Similar experiences have been reported by Clark of Philadelphia and Wyeth of New York.

Our own experience in the treatment of lesions other than of the genito-urinary tract has been considerable and our results warrant marked enthusiasm over the method. It is often possible in a few seconds or minutes to destroy malignant growths which would otherwise necessitate frequent and prolonged use of x-ray or radium.

We wish to emphasize again that surgical excision of any tumor, benign or malignant, regardless of its location, may be the procedure which will precipitate local recurrence or regional metastases. Patterson, in discussing diathermy in the treatment of malignant disease of the mouth, nose and pharynx, states: "Every practitioner should be alive to the danger and grave significance of an ulcer or indurated area occurring in the tongue, mouth or pharynx of a patient over middle age. Excision of tissue will clinch the diagnosis. There is one objection to this method, namely, that even such a small operation is followed by a more rapid advance of the growth, and this is especially true if some of the surrounding healthy tissue is removed at the same time."

The following tabulation embraces the new growths which we believe can be best treated by electrocoagula-

TREATMENT OF ACCESSIBLE CARCINOMA

tion. This holds true whether they are benign, potentially malignant or actively malignant and whether they are cutaneous, membranous or fibrous in origin.

1. All cutaneous neoplasms: warts, angiomas, lymphangiomas, keratoses in general, papillomas, epitheliomas, rodent ulcers, melanoses, xanthomas.

2. All accessible neoplasms of membranous origin: malignant growths of the lip, tongue, mouth, tonsil, pharynx, larynx; nasal passages and accessory sinuses; carcinoma of the breast, cervix uteri and rectum.

3. Sarcoma, when accessible and not involving essentially vital structures.

As yet no technic has been developed for the coagulation of carcinoma occurring within the peritoneal cavity. This has been largely due to the possibility of subsequent sloughing, infection, or hemorrhage in areas where these sequelæ can not be controlled.

The eradication of neoplasms, regardless of their location, can be accomplished by either desiccation or thermoelectrocoagulation. The technique of these procedures has been fully described in the previous chapters.

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